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INCOMPLETE ADAPTATION AS ILLUSTRATED BY THE HISTORY OF SEX IN PLANTS.[1]

BY LESTER F. WARD, A.M.

THE doctrine of abrupt changes or cataclysms in nature has a remarkable survival in the still prevalent belief in perfect adaptation. As it was formerly held that organisms were purposely made for their conditions and exactly adjusted to them, so now, since the law of self-adjustment has become current, it is supposed that the organism and the environment have in all cases reached a condition of complete correspondence. It is in virtue of this assumption that the law of cross-fertilization of plants has been called in question, and an eminent botanist once remarked to me that the slight difference between the results of Darwin's experiments under cross and under self-fertilization, amounting on an average to one-fifth of the whole, was sufficient to invalidate that law.

Nothing seems so difficult for the human mind to grasp as change through minute variations indefinitely continued. Even those who admit that this is nature's method, fail to realize it in concrete examples.

We may suppose that a given character not possessed by a given species would, as a matter of fact, be an advantage to such species if it could acquire it. We may further suppose that for any reason the species commences to vary in the direction of acquiring that character. The benefit will be proportional to the degree of completeness with which the character is attained.

[1] Read before the Biological Section of the American Association for the Advancement of Science, at Boston, August 27, 1880.

Under the law of natural selection, the perfection of the character will ultimately be reached, but a very long period, to say the least, must elapse during which it is still incomplete.

Again, the conditions surrounding a species are constantly changing, usually slowly, but sometimes rapidly or suddenly. In this way the usefulness of certain characters is frequently destroyed, but the species cannot lose the character; it persists and gradually becomes atrophied or transformed into a different one. Such changes in organisms are very slow, and vast periods are passed through before they are completed.

Now, considering the changes going on at all times in the conditions under which species exist, it may often happen that the period during which adaptation is incomplete from both these causes, is greater than that during which it is complete. Indeed, as a matter of fact, the adaptation is never absolutely complete, the organism being always, as it were, behind its environment, as the tides are behind the moon.

If this be true, we ought to expect constantly to find examples of incomplete adaptation. A character which required to be complete before it could be advantageous could never be acquired by natural selection. All such characters as are acquired must be advantageous in proportion as they are complete.

Naturalists must therefore learn to regard a large proportion of the characters which they find to exist, as partial or uncompleted characters, useful to the species in proportion as they are developed, but capable of greater adaptation.

There are, moreover, two general classes of characters with respect to their usefulness and advantageousness to the species. Those of one of these classes are only useful to a certain limited degree, beyond which they may be injurious, and which only apply to particular species in their relations to definite existing conditions. Such characters may be called *special.*

The other class, which may be distinguished as *general,* apply to all organisms, and are less limited in their degrees of possible development.

Passing over the class of special characters, I propose to illustrate the principles above stated, by an example in the class of general characters taken from the vegetable kingdom.

The distinction of sex is a condition advantageous to all plants, and one in the process of attaining which a large number of grada-

tions are to be found. The purely asexual state exists only in the lowest Protophytes, as in Saccharomyces, the Phycochromaceæ, and other unicellular forms. The simple phenomenon of conjugation or copulation seen in the Zygomycetæ and diatoms, forms the earliest step towards sexual differentiation, which is followed by the various intermediate steps represented by the pairing of active cells in Volvox, the formation of oöspores in the Confervæ and Fucaceæ, and of carpospores in the Fungi.

In the Characeæ we first find the well marked distinction of antheridia and carpogonia, the former furnishing in Nitella the active spermatozoöids which differ immensely from the cells with which they combine. This latter feature continues to characterize all the higher Cryptogams, though in nearly all cases the organs of both sexes are borne on the same plant. The transition from the Cryptogams to the Phanerogams is effected by a primary differentiation of the spores, which in most Cryptogams are the independent asexual bodies that produce the sexually differentiated prothallium. This prothallium loses its independence and becomes the albumen of the seed; the male spores are converted into pollen grains and the antheridia into the fertilizing pollen-tubes; the female spores are transformed into embryo-sacs containing corpuscles within which are the ultimate germ-cells.

In a certain sense this transition, instead of marking an advance in the process of sexual separation, constitutes a step backward, since the prothallia of Cryptogams, considered as distinct individuals, are respectively male and female, while the stamens and pistils of the Cycadaceæ and Coniferæ, the earliest Phænogams developed, though quite distinct in themselves, are both borne on the same plant. But the prothallium marks the highest development reached or possible to the Cryptogam. The Phænogam must begin from a point lower down, and in turn evolve sexually differentiated forms. The distinction of macrospores and microspores found only in the Rhizocarpeæ and Ligulatæ, and which, as already stated, initiated the transition from the Cryptogams to the Phænogams, took place in the same individual, both kinds of spores often occurring in the same sporangium, as in Salvinia. This, when the two kinds of spores at length came to represent the two sexual organs of the Cycad or the Conifer, necessarily reunited the sexes once more in the same plant, and the process of separation, so well completed in the higher Crypto-

gams, was required to be begun anew on the higher Phænogamic plane of development.

From this point, however, the history of this process is of the highest interest. In the Cycadaceæ complete dicœcism was reached before any of the few now existing forms were developed, and all present living species are male and female. In the Coniferæ, different families have attained to different degrees of diclinism. The Taxineæ, which many facts show to have been among the earliest forms developed, are dicœcious, while the great pine and fir tribes, as well as most cedars, are still moncœcious. Both these great orders have come down to us from the Carboniferous epoch, and indicate, along with the remnant which we possess of the then luxuriant cryptogamic flora, the kind of vegetation which prevailed in those remote ages. The flowers even of the highest forms were uniformly inconspicuous and odorless. The only possible substitute for sexual separation was the distribution of pollen by the winds. Forms so high in development, it would seem, could not continue to exist through self-fertilization alone, and hence, under the operation of natural selection, more or less complete sexual separation early took place.

The transition from the Gymnosperm to the Angiosperm is veiled in great obscurity. Certain considerations point to the gradual transformation of the Cycadaceæ into the Monocotylæ through the Palmaceæ or some allied family, on the one hand, and to that of the Coniferæ into the Dicotylæ through the Gnetaceæ and Casuarineæ, on the other. However this may be, the earliest known fossil species of Angiosperms, dating back to the early Trias, consist of poplars, beech, oak, chestnut, sycamore, and other unisexual and dicœcious trees, all of which want the showy flowers characteristic of the present flora of the globe.

In view of the fact that this early flora was to so great an extent diclinous, it becomes an important question why so large a proportion of the present flora is hermaphrodite. We find that many of the plants of the most recent geological development possess the means of self-fertilization within the same flower and no obvious means of crossing individuals. Upon closer observation, however, we perceive that many of these apparently perfect flowers possess arrangements of a more or less anomalous kind, which, inexplicable on any other theory, are all explainable as contrivances for the prevention of self-fertilization. The com-

pleteness with which this object is accomplished is of all degrees, from Epilobium with its style merely turned to one side, to Iris with its short extrorse anthers hidden away under the broad styles stigmatic on the inaccessible side; from mere heterostyly to complete dichogamy.

I need not review the conclusive reasoning by which all these morphological modifications are accounted for as the results of the long continued agency of insects. It is important only to point out that this influence has been powerful enough to reverse the entire course of sexual differentiation, which, as we have seen, has been in all lower forms constantly in the direction of a more and more complete separation of the sexes. It may be said that this proves too much, since progress in that advantageous direction once gained would not be likely to be lost. The sufficient reply to this is that, independently of the natural tendency to revert to the normal or monosexual state, when the separative influences are withdrawn, the reserve power of possible self-fertilization when for any cause cross-fertilization fails, as it clearly often may, is a positive advantage, and one which, under the proper circumstances, natural selection will insure.

The most significant fact which palæontology reveals is that of the simultaneous appearance of an insect fauna and a hermaphrodite flora. When the insects came upon the scene they found only a diclinous flora with usually apetalous flowers destitute of both fragrance and color. The succeeding strata immediately commence to exhibit plants of the rose, mallow, magnolia, pulse, and crowfoot families with showy petals, often fragrant, and provided with special nectaries for the secretion of honey. Most of these had already made their appearance in the chalk formation, while during the Tertiary the still more perfectly organized Gamopetalæ were developed. The agency of insects in the fertilization of plants and even in the transformation of flowers to adapt them to their uses is no longer questioned by any at all familiar with the facts, but wide differences of opinion exist with regard to the degree of this influence, and also to the meaning of particular facts. Much of this confusion is due to the prevalence of the notion to which attention was called at the outset, that all adaptation must be regarded as completed at the present time. This assumption of a statical condition in nature now, while admitting the necessity of a dynamical condition in the past, is

wholly gratuitous and belongs, as already remarked, to the same class of ideas as that by which all changes were once explained as the results of great and sudden catastrophes. It is due to the kind of reasoning which denies change to everything which can not be seen to move—a kind of reasoning which leads the savage to deny that the great trees have ever been other than they are,[1] while admitting growth in the herb and the sapling. In point of fact we find nearly all possible degrees of adaptation to the agency of insects. The mere existence of colored flowers must be regarded as an initial step in this direction, and the greater part of all flowering plants exhibit in a more or less marked manner this evidence of the influence which insects have exerted upon them. But it is evident that an ordinary hermaphrodite flower, however showy or fragrant, if devoid of special appliances for preventing self- and securing cross-fertilization, represents a very rudimentary and imperfect state of correlation to the insect world. This condition, which is now the predominant one, must therefore be regarded as constituting the first step of a long progressive series of morphological changes in the same direction, all tending to complete the degree of adaptation to insect life. The various specializations which a few species have already undergone mark so many additional steps taken by such species toward the same end and afford a faint idea of what the whole flora of the globe might become in the remote future, if wholly uninfluenced by man.

In the great majority of plants, self-fertilization is doubtless still the rule, and cross-fertilization the exception, but this occasional crossing, even though very rare, suffices to maintain the vigor of the stock. Such plants will appear to thrive as well when self-fertilized as when cross-fertilized, and this would probably be the case if the experiment were repeated a great number of times, for it is not once or a score of times, or a hundred times even, that count in these processes of nature, but vast periods and innumerable repetitions, each with its minute differential to add to or subtract from the general sum. When these facts are properly understood, therefore, the partial or total failure of all human experiments on cross-fertilization becomes nothing more than naturalists ought to expect. The really surprising fact in such

[1] See an address by Maj. J. W. Powell, delivered before the American Geographical Society, at Chickering Hall, New York, Dec. 29th, 1876.

experiments is that some of them actually do show a clear difference in favor of cross-fertilization. It may be compared to the attempt of astronomers to obtain the parallax of a fixed star. The result is in the highest degree satisfactory if it is certain that any positive angle is measured. And, as in the astronomical parallax, the greatest exactness is required to measure the vastness of space and its contents, so in the biological parallax equally great precision is needed to measure the vastness of time and its effects.

Independently of insect agency, however, the vegetable kingdom furnishes many facts which prove the unstable state in which the sexual relations are still found to exist.

In many cases it is difficult to determine whether the movement is at the present time towards a greater or a less degree of separation. In a former paper read before this Association[1] I endeavored to bring forward the evidence to prove that certain species of Lauraceæ, and notably the genera Sassafras and Lindera, had already passed through three different stages, of which traces are still left in the form of "rudiments" or obsolete organs. In this case the movement has obviously been towards more complete sexual separation. In the majority of other common cases, such as Smilax, Ilex, Rumex, Rhus, Chamælirium, &c., where the rudiments of both stamens and pistils remain, though one or the other set is functionless and the plants are really diœcious, the direction of development seems also to be towards sexual distinctness, and it may well be doubted whether the flowers of the oak, the alder, or the willow were ever hermaphrodite. Still, progress toward hermaphrodism may also be going on in some species where insect fertilization is found a sufficient substitute for the distinction of sex.

Upon the whole, however, it must be concluded that the special effect of the appearance of insects in the Mesozoic or Secondary age of geology was to render the evolution of new hermaphrodite forms possible, which vastly enriched the world's flora, since prior to that time only diclinous species could survive, and that this great army of plants, having been thus brought into existence in this imperfect condition, have since been gradually throwing off their encumbrance, and at different rates moving forward toward sexual independence.

[1] Published in the *Scientific American Supplement* of Sept. 20, 1879, p. 3089.

A PARTIAL BIOGRAPHY OF THE GREEN LIZARD.

BY SARAH P. MONKS.

THE green lizard *(Anolis principalis)* of the Southern United States is sometimes called the American chameleon, but it is not related to the chameleon of the Old World.

Its changeable coat, however, gives it a popular right to the name. Two specimens of Anolis that I have kept for months in a wire-cloth cage, have shown some interesting habits.

The female came from South Carolina in November, 1879, in good condition, but with the greater part of the tail wanting. She was placed in a small cage and supplied with flies, but refused to eat. During the winter the cage stood among house plants, in a room heated by a furnace, and although she was lively and ran around a good deal, she ignored the flies. Thus she remained without food and water (except an occasional drop that fell by accident when the plants were watered) for four or five months.

But when the warm spring days came, she greedily devoured the flies, and when water was sprinkled in the cage, she eagerly lapped it up with her tongue. It is said that the Old World chameleons drink in the same manner. She would not notice water that was in a small jar in the cage, although very thirsty.

Sometimes when I approach the cage she lifts her head and opens her mouth. I do not know whether she is conscious of asking for water, but I soon recognized this as an indication of thirst. In April a new tail began to show itself, looking like a small black wart, and since then it has grown nearly an inch. At first it was distinct and looked like a graft on the other portion, but now, after several moultings, it is continuous, although it can be easily distinguished from the rest; the scales are smaller, it always remains darker than the rest of the body.

About the middle of May another and larger specimen, a male, came from South Carolina, and I put them in a large box in which were twigs and a stick of wood. After the larger one had dined, their antics on seeing one another were exceedingly amusing.

First, one would raise itself to the full extent of its front legs, and bow its head and the fore part of its body in a regular and dignified manner. It worked as though there was a hinge joint at the shoulders. Then the other would repeat the gesture. The male, when bowing, erected a small nuchal crest, and after several bows, held its head still and stiff and distended a dew-lap.

This expansion, of which ordinarily there is no trace, is not inflated, but is a flattened disc about an inch in diameter. It is orange-red in reflected, and crimson in transmitted light. At this time the lizard is a beautiful sight, the body being green above and white below, and the vivid dew-lap edged with white.

I have seen them bowing several times, but they scamper off on finding themselves watched; and even in the midst of their ceremonious courtship, if a fly comes near they dart after it like a flash of green light.

There is a difference in the change of color in the two specimens, and the same cause does not affect them alike. The female, in the day time, is generally dark-brown, or drab, speckled with white, and has a lighter dorsal line. Sometimes, however, she is grayish. When very dark, even the under side is brown, but when lighter colored the under side is gray, or white. But at night she becomes some shade of green, rarely a pale-green. Once or twice during July I have seen her green in the day time. On the other hand the male is generally pale-green. Their colors are different shades of green, yellow and brown. When changing, the coming color does not suffuse the entire body at once, but first appears on the legs and sides of the head and the body, the dorsal line and tail often remaining darker long after the other parts are light-colored.

When they are green, yellow, or drab above, they are white below; when dark-brown, a lighter shade of the same color below; and sometimes I have seen them a uniform dark brown. Occasionally, the light-green color remains on the eye-lids and a few scattered scales of the body, after the other portions have become brown. They do not always grade regularly from brown, through yellow, to green, but sometimes change from dark-brown to pale-green and white, without showing yellowish. The bronze (yellow) is the rarest color, and is very seldom assumed by the female. They change from one color to another in from two to eight minutes, and one changed from green to light-brown, then back to green again, in five minutes.

I see no reason, as yet, for this changing of color, for it comes regardless of the object on which they are placed, or amount of light and darkness. They become green or light-brown when placed in sun-light, but also assume the same colors in the darkest room. When disturbed, they sometimes get darker, and at other times do

not change. Nor do they always appear conscious of a disturbance when a change of color occurs, since I have turned the cage towards artificial light, and found the lizard sleeping and of a green color. In less than two minutes it was dark-brown, and still apparently sleeping. Another time a light held near the cage did not cause one to open its eyes, but in less than thirty seconds a brownish tint had taken the place of the green.

My observations on color-changes have been contradictory and unsatisfactory. The lizards enjoy the sun-light and remain basking for hours motionless, except for their rolling eyes, which notice everything. They go to sleep as soon as it becomes dark, and are not easily disturbed. They also go to bed when a storm brings darkness, and wake again when the sun appears, although not exposed to its direct rays. They are sensitive to degrees of light, but how direct sun-light and darkness can affect their skins and produce the same color-change is a puzzle.

They have several ways of sleeping. Sometimes they lie close up under a bit of loose bark (this is generally on cool nights, or when left out of doors later than usual); at others, they curl in a sigmoid shape in a corner behind a small jar; and at others they stretch out straight and stiff along a limb or among the twigs. And their sleeping habits are the most interesting of any I have noticed. When they are in a crevice, or hole, they take any shape that is convenient, but when on sticks and twigs, they arrange themselves so as to imitate the general form of the branches. In the cage there are some irregular twigs and a small horizontal stick. When on the horizontal piece the lizard stretches itself out straight, with its forelegs pressed closely to the body, and the hind legs and tail so straight along the branch that the bend of the knee shows as a dimple. When sleeping among the twigs it is arranged, head downwards, on the largest, with its forelegs close to the body, but the hind legs spread out at different angles. Often one leg will be straight and the other bent, at other times both have the same bend, but always resembling the branching of twigs. They so closely imitate this when they are dark-brown, that often, at first, before I learned their tricks, I would search for them all over their cage, fearing they had escaped.

The lizards are fond of flies, often snapping up eight or nine, one after the other, as quickly as they can swallow them. I saw one once with two flies in its mouth preparing to catch another.

I never saw them protrude the tongue to catch them. Sometimes, with slightly open mouth, one will creep cautiously towards a fly and seize it with a quick snap, at others they will jump twice their length and catch it. They feed at night if near a bright light. I tried to feed mine with rose bugs (*Macrodactylus subspinosus* Fab.), of which our supply this year has been much greater than the demand, but they refused to have any thing to do with the spiny creatures. After catching a fly they generally move it around in their mouths, seeming to crush and moisten it before swallowing.

In shedding their skins they differ from snakes and such salamanders as I have seen exuviate. The skin splits along the back, and the upper sides of the legs, and comes off in large fragments. It is loose on the legs and tail first; the lizard seizes a bit in his mouth and pulls it off his feet like an inverted glove; then he eats it. Pieces that he scrapes off against the branches, he does not trouble himself to collect as food. It seems a difficult matter to remove the old skin from around the jaws and eyes; I have seen them rub and scratch a good deal and still wear tatters of their old garments around the head for several days after the rest of the body was polished off. I saw one once kick many times at an annoying piece on its head with its hind foot in much the same way a cow will try to scratch her head. He would curve the body and give a vigorous scratch or two, then quickly turn the other side and use the other foot.

When the tail has been broken off and renewed, it skins independent of the rest of the body.

I do not know if there is a regular time for changing skin, but suppose it depends on the general health and the growth of the animal. One of mine changed twice in seventeen days, and the other only four times in five months.

I have found three eggs in the cage at different times, but they soon shriveled up and amounted to nothing.

My specimens occasionally get in the corners and dig at the wires trying to scratch their way out, but generally they seem contented, enjoy basking in the sunshine, and watch me closely with their quick brilliant eyes as though they knew I furnished them with food. *July, 1880.*

A NEW LEAF CUTTING ANT.

BY G. K. MORRIS.

ISLAND Heights is the name given to a camp meeting ground and summer resort on the New Jersey coast, near the ancient village of Toms River, and situated on Barnegat bay. For many years the greater portion of the island was neglected by man. It is but two years since the woodman's axe sounded the signal of approaching change. It is now a pleasant summer town.

This summer, early in July, I took up my abode there for the term of my vacation. My first observation was, that the place was an Eden for ants. In an unimproved block two hundred feet square, there are nearly forty species, representing several genera.

Of course most of them are well known; but nineteen of them were strangers to me and such authorities as I was able to consult. These have been sent to Dr. Forel for determination.

One of the number, the most curious and interesting of all, is a leaf cutter, said to be new to science both by Dr. McCook and Mrs. Treat. The worker is a fraction over an eighth of an inch in length. The male and female are nearly of a size, and but little larger than the workers. In color, as seen in mass in alcohol, they are light brown. The head is dark, and a dark band runs down to the point of the abdomen, which on the under side is lighter. The head is rugose, and the entire surface of the body is rough and hard. On the thorax and the metathorax there are short spines. The node is like a rough irregular bead with the thick end next to the abdomen. The mandibles are toothed and seem striated on the outer surface.

When first observed these ants were marching in line, each one laden with a piece of the fine needle-like leaf of pine seedlings. They did not carry their loads as other ants do, but on their heads, resting between two ridges that extend from the base of the antennæ to the top of the head. Some of them carried pieces longer than themselves, in which cases the needle lay along the back, one end being held in the mandibles. Tracing them to the seedling, which was nearly a rod from their formicary, measured by their path, I found them engaged in cutting. It took but a moment for one of them to sever a leaf. Some pieces lay on the ground as if the cutter had been delegated to that work, but as I watched, each cutter carried down the piece he had cut and bore it to the nest.

In the line marching towards the nest, was one carrying a small white stone, and others carrying the striated droppings found under bushes on which worms are feeding. The only other leaf carried by them, so far as I have observed, is the leaf of cow wheat *(Melampyrum americanum)*, a plant which abounds in the woods. Of this plant they collect the flower as well as the leaf.

On the 17th of August I dug out a formicary of the leaf cutter in the presence of Mrs. Treat, who, having heard of my observations, came on to see for herself. Our discoveries were startling. Instead of small cells we found what, in comparison to the size of the ants, may be called caverns. Unfortunately these were crushed by the spade, so that their size and shape could not be accurately determined.

In the cells were masses of spongy material of a leather color, and full of irregularly formed cells or pockets in which were some callow ants and many mature ones. Two of these large cavities were found containing this strange material. It was evident that the ants manufactured the leaf cuttings into a soft nest for their young. There were a few males and females, and one ant without wings much larger than any others in the formicary.

The spongy material broke down with handling, but showed its vegetable origin under the glass. Indeed, a few of the particles found in the first cell, near the surface of the ground, had not entirely lost their green color. Our impression was, that the leaf matter was partially masticated and then webbed together.

On September 8th I selected for examination a nest in a more retired locality, and from which the trees had just been removed. Immediately under the turf, not more than three inches below the surface, was the first cell. It was about the size of a large coffee cup and not far from the shape of one. The sides were smooth, compact and firm, though made in the clean white sand. They were lined with fine yellow sand which had been brought up from a depth of about two and a-half feet. This seemed as if held loosely together by a web-like substance and constituted a thick soft curtain against the walls. On the floor lay a mass of the porous, spongy substance found in the first nest. A few ants were found here differing in size and color; one was nearly red, another brown with dark band, and others grayish. The latter were callow.

Adjoining this was a small cell one and a-half inches in diame-

ter, containing very little of the substance described above. In the loose material on the floor of this cell were found living forms of minute size, and unknown to me.

Five inches distant was a still smaller cell, in which closely stowed away, were ants, apparently prisoners. The approach to their dungeon had been plugged for the whole distance with the yellow sand, so that it could be traced like a yellow streak in white candy.

Three inches below the level of the cells last described was another three and a-half inches deep, two and a-half wide by three and a-half long. In form it resembled a coffee cup flattened slightly. I was fortunate enough to approach this one so carefully as not to disturb its interior arrangement. Having made a pit by the side of it, I carefully cut away the loose sand with a large knife until one side was removed, and the wonderful architecture within was before my eyes. I ceased work in utter astonishment. My excitement was intense, and my delight indescribable.

The floor was covered with small smooth pebbles. The bulged side of the cup was protected by a curtain of yellow sand fully a-half inch thick in the middle and tapering to nothing at top and bottom. The white sand in which all this wonderful work had been done, was packed and smoothed and almost glazed until it had become so firm that no jarring would shake a particle from its place.

But what most filled me with wonder was the resemblance of the interior to a bee hive. Suspended from a tough root at the top of the cell, and nearly filling the entire space, was what resembled a honey-comb in all save regularity of form. There were several masses of it hanging side by side as in a hive. In place of regular cells, however, were irregular pockets, in which the young are reared.

I cannot tell the reluctance with which I removed this comb, nor my regret at the impossibility of preserving it just as it hung. However, it is preserved, though not in form as found, and is before me as I write. It has been seen by Dr. McCook, who has made a study of the leaf cutting ant of Texas. In his opinion the ant I have described is an Atta. He came to the heights and investigated a formicary, but was unfortunate in that the day was stormy. He succeeded, however, in verifying my observations.

COMPARATIVE NEUROLOGY.

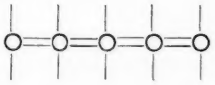
BY S. V. CLEVENGER, M.D.

[*Continued.*]

AT this stage the so-called afferent commissure alone is established, but the same law of unification of segments in the construction of an individual from its component colonial members will also confer upon it an efferent commissural system.

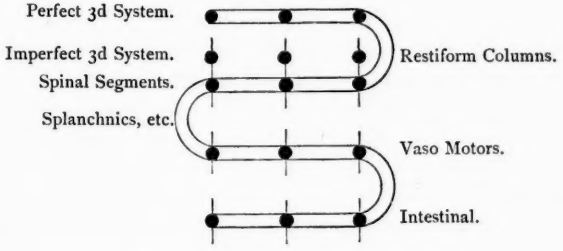
While this is intended to represent the visceral nervous system of Invertebrata, the same rule will apply in the union of vertebral ganglia segments in higher forms, beginning in such Invertebrata as possess more than one secondary system ganglia (some Arthropoda).

Ganglionary fusions occur in parasitic insects and other forms, but this is secondary and does not interfere with the general application. By omitting the afferent part of the fibers that form the commissures, the segmental union may be expressed thus, and confusion avoided:

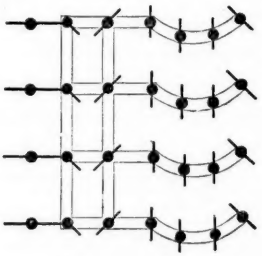


These may be schematically expressed in diagrams which show the higher ganglionic series to be commissurally connected with the lower. Each higher segment presiding over a lower system series and the commissures between forming apparently, direct projection systems.

This scheme would explain why the splanchnics have no inhibitory control over the intestines (Ludwig and Haffter), such control really pertaining to higher projections (Ott).



Each spinal ganglion segment presiding over a similar series would be thus represented:



While each and every ganglion preserves its primary projection functions, the commissures interrelate the systems and are themselves projection fibers.

The third system in this diagram is incomplete in not being commissurally connected, hence it is but a ganglionic (intervertebral) swelling upon the secondary spinal afferent nerves, and attains its complete functional character within the cranium only.

In Trigla adriatica the brain and dorsum of the cord are marked by a double chain of well-developed tubercles on the secondary nerves just as they enter the cord. These ganglionic enlargements are exact reproductions of the cerebellar and cerebral enlargements, en chatelaine. These intervertebral ganglia constitute the third system, the difference between the spinal ganglia and those above being that the latter are commissurally united to one another, and in higher Vertebrata fused longitudinally.

The vermis of the cerebellum is probably a mere commissure compounded of different segmental heights, for the transverse striations are pronounced in birds and some reptiles.

According to Owen, the cerebellum (vermis) retains its embryonic form of a simple commissural bridge or fold in the parasitic suctorial Cyclostomes and sturgeon, and in the almost finless Lepidosiren, while the cerebellum (still vermis, because centrally placed) is highly developed in the sharks. In the saw fish it even rests upon the "cerebrum."

The first well-marked posterior ganglionary mass which in higher Vertebrata becomes a portion of the cerebellum, is the vagus tubercle, placed posterior to and below the "cerebellum" of the fox shark. It might be safe to assume that subsequently

this tubercle (third system ganglion) forms the flocculus or pneumogastric lobule of the cerebellum.

The Gasserian ganglion (unmistakably an intervertebral), where non-existent, must form a portion of the cerebellum.

The cerebellum then appears to be formed from fused hypertrophied intervertebral ganglia.

Stilling regarded the law of isolated conduction as inapplicable to the cerebellar lobes, owing to the very great commissural (fused) union which occurs there. Thus a coördinating function between cranial nerves on the one hand (the cerebellum acting as connected intervertebral ganglia for many cranial nerve fibers), and the general spinal system on the other, must follow in such Vertebrata as are governed mainly by cerebellar supervision, while in higher forms it is brought directly into relation with the cerebrum itself.

Above this the cephalic intervertebral ganglia developed in some animals, atrophic or rudimentary in others, appears to be the posterior and anterior tubercula bigemina, epiphisis cerebri, eminentia mammillaria, olfactory lobes, cerebrum, which latter is itself composed of several lobes or ganglia, some of which, as the anterior, are undeveloped in most Vertebrata and even in many mammals.

The posterior bigeminal lobe appears to be a third system ganglion related to special tactile sense (see Spitzka, N. Y. *Medical Record*, March 13, 1880), while the optic lobes (anterior bigeminal) are third systems for the optic nerves. The primitive optic fibers were related to the gray matter above the chiasma, and even in man retain some primary thalamic connections.

The epiphisis cerebri (pineal gland), bilobed in the fœtus and devoid of sabulous matter in forms below man, attains quite a large size in some animals (*Meleagris gallapavo*, p. 260 "Huxley's Vertebrates"). It may with the mammillary eminence indicate a sense between sight and olfaction.

The mammillary eminences can be third systems, their positions and cinereal envelope weighing nothing against the idea, for the Teliost cerebrum itself drops to a comparably defective structure and inferior position.

These eminences are very large in monotremes, marsupials and the horse. They stand related to the fornix, which in turn is connected to the olfactory lobe.

The olfactory lobe (another third system ganglion) appears to have been derived from a place lying in front of the mammillary eminences, according to Luys' sections, but Meynert is doubtless more correct in attaching the olfactory primitively to the optic thalamus.

The olfactory lobes, of more importance in some vertebrates than the cerebrum, in man became strangled, so to speak, by the preponderance of higher third systems.

("The olfactory lobe bore such important relations to the life history of early vertebrates that we are not surprised to find the *cerebral hemispheres* developing at first as mere appendages of the olfactory lobes."—Spitzka, "Architecture and Mechanism of the Brain," p. 37.)

The lobes of the cerebrum are related to the corpus striatum, which seems to be a part of the medullary gray second system, though formed after the hypophysis cerebri had become atrophic as the end of the spinal cord.

The hypophysis ended in the sella turcica and the corpus striatum (caudate nucleus), and subsequently lenticular nucleus developed in the scale of intelligence (Meynert).

In Teliost fishes the optic lobe (third system) occupies the place of the cerebrum of mammals in point of mass development, and the inference is natural that this optic lobe contains the highest centers related to the psychic life of this division of vertebrates. The cerebrum proper being an undeveloped tubercle in front of the mammillary eminence with the infundibulum between them (Todd, p. 619, Vol. III).

In Amphioxus we have the culmination of the secondary ganglionic type with the foreshadowing, seemingly, of the tertiary, in the black pigmentary formation in the dorsal portion of the notochord. This vertebrate, so far from being anomalous, explains by its rudimentary organization what appears later in the Cyclostomi or above. Its second pair of nerves runs from the dorsal segmental nerves to the head-end ganglion, thence to the ventral segmental nerves, typifying the medulla oblongata control over lower centers, without the intervention of a cerebellar or any other third system.

The optic ganglion (secondary) of the crab *(Carcinus mænas)* topographically precedes the antennal, from which may be inferred that the posterior bigeminal (tertiary) is related, as Spitzka claims, to the special tactile (fifth pair) sense.

The slight development of the superior ganglia in Brachiopoda is correlated with higher sensory organs, and Gegenbaur, p. 310, notices that the nerves for the arms are probably given off from the *ventral ganglia*, a condition which I suspect is more common than usually thought to be the case, due to the want of differentiation between alimentary and locomotor parts, so far at least as central innervation is concerned. "In the Mollusca the visceral ganglia are not only of importance, as forming a part of the general nervous system, but they may also fuse with the cerebral ganglia, owing to the gradual shortening of their commissures. New and primitively peripherally placed parts are thereby added on to the central organs, and it becomes a matter of doubt whether or no these ganglia, which formerly belonged to the visceral nervous system should still be regarded as belonging to it."—Gegenbaur, p. 344.

The development of the nervous system appears to have proceeded as follows:

PRIMARY.

Intestinal—Circulatory and visceral, cardiac.

SECONDARY.

Respiratory—Special tactile locomotory, auditory, optic, or optic and next auditory.

Antennal special tactile from which auditory in some; (olfactory not certain in Invertebrata, possibly in Cephalopoda. *In Vertebrata originate highest secondary and tertiary).*

The progression of faculties intermingle and a branch sense appears often to develop indifferently from one or other trunk, as while respiratory may give rise to the tactile for locomotion, and audition follows upon this, the antennal for gustatory purposes may originate the auditory, while locomotor tactile may be developed separately.

NERVOUS ORGANIZATION OF INVERTEBRATA.

1. *Protozoa.*—Not perceptibly differentiated.
2. *Cœlenterates.*—Rudimentary primary.
3. *Vermes.*
4. *Echinodermata.*

Secondary appears and becomes highly developed. Often fused with primary.

5. *Arthropoda.*

Secondary well developed. In Insecta the primary quantitatively developed. Tertiary pronounced in bee.

6. *Brachiopoda.*—Degraded secondary.

7. *Mollusca.*
   - Resemble Vermes.
   - Secondary feeble in Lamellibranchiata.
   - Secondary well formed in Gastropoda.

8. *Tunicata.*
   - Secondary well defined (extending by commissures dorsally (?) Copelata).
   - First appearance of extended secondary in Invertebrata.
   - Anterior ganglia vesicularly developed.

Gegenbaur (p. 501) justifies this view of the central nervous system of Vertebrata being homologous with the superior central ganglia of Invertebrata "in an exceedingly high state of development."

The dorsal position of the central nervous system can be well made out in Tunicata. It proceeds from ectodermal differentiation.

An anterior larger mass divides into three consecutive (secondary) lobes, produced by unequal thickening of the walls of the central tube.

The anterior mass is in connection with the origin of the visual organs in Ascidiæ, Salpæ and Copelata.

A median dorsal nerve cord appears in ascidian larvæ, which prolongation Gegenbaur, p. 396, regards as noteworthy as being the only *dorsal* prolongation in Invertebrata, and thus a medullary secondary central system appears stretching the length of the animal.

Notwithstanding the feeble development of the cerebral ganglia in Mollusca, the homology of these ganglia with the cerebral ganglia of Vermes and of Arthropoda has been clearly made out. There exist in Arthropoda and Mollusca cerebral (secondary) ganglia connected with nerves of special sense and visceral (primary) ganglia innervating, in Mollusca, the heart, branchial apparatus and generative organs, comparable to the "stomato gastric nervous system" of Arthropoda.

The ventral chain of ganglia, so obvious in Crustacea and Insecta, partakes of primary or secondary characteristics, or both, depending upon the position of the metamera and the degree of development they have undergone. With concrescence of the anterior metamera into a more or less extended cephalothorax, the anterior ganglionic masses are fused, as in Stomapoda, where

a portion of this ventral chain innervates the anterior buccal and and prehensile feet, while the six smaller ganglia of the abdomen still correspond to the segments and have more apparent primary than secondary significance. In Arachnida, where nerves are given off to the enteron from both the cerebral and ventral ganglia, an appearance is presented of the vertebrate pneumogastric projection.

Recent embryological observations, as set forth by Balfour ("Comparative Embryology," Vol. I, 1880) from monographs of Kowalevsky, Kleinenberg, Fol, Lankester and others, distinctly show that where the nervous system has been made out at all, as a rule it proceeds from epiblastic thickening and differentiation.

The First System arises from intestinal innervation, the ganglion of which affords, in Invertebrata, locomotor nervous control. The respiratory, digestive, and excretory functions, as in larva of dragon fly and fish Cobitis, being performed, not only by the same sets of nerves, but the same organs *(vide* Darwin's "Origin of Species," p. 170). We have seen locomotion to proceed as an accidental accompaniment of respiration (Branchipus), and the sub-œsophageal ganglion innervating the second pair of antennæ in Nauplius.

The vaso-motor division of the first system is added when the mesoblast appears and the vascular is differentiated. The concentration of the fibers and ganglia of this system in certain areas, as the solar plexus, renders any attempt at systematic classification of strands, etc., futile, but by studying the arrangement of the sympathetic system backward from the præ-vertebral ganglia, the warrant for the scheme I have adopted is more apparent. The præ-vertebral are united by longitudinal commissures, precisely as in the ventral chain of ganglia in Arthropoda; often as in the cervical region these ganglia coalesce to form larger nerve centers, precisely as in cephalo-thoracic formation from metamera, or as in the leech; one ganglion may in the adult represent three of the embryonic segmental ganglia.

No matter how exalted the function or position pertaining to a ganglion *in any system*, it does not lose its identity as a simple center from which afferent and efferent fibers proceed. The præ-vertebral chain presides directly as centers over the immediate vascular area with which it lies in contact, with its more or less obscure peripheral projections, while the commissural system

binding it to the visceral plexuses lengthen and broaden out into such great fasciculi as the splanchnic and cardiac nerves.

Second System Ganglia.—By quantitative caudal development of the cerebral ganglia homologies of Invertebrata, as supra-œsophageal, optic, auditory, pedal, or tactile, commissurally connected by afferent fibers posteriorly (columns of Goll and Burdach), and by efferent fibers anteriorly (columns of Türck and anterior fundamental tract), a view is obtained of the primitive spinal cord segments ununited. Spitzka records that the planes of junction of the original segments may be still made out by the poorness in cellular elements of such areas under microscopic examination, while the centers of the spinal ganglia are determinable by their richness in these elements. Longitudinal fusion and consequent shortening of this chain forms the central tubular gray of the spinal cord.

The "medullary white" of Flechsig first appears in the columns of Burdach, in the fœtus of 25 c.m. Spitzka says it also appears in the processus cerebello ad cerebrum. This is reasonable, for the processus cerebello ad cerebrum is a continuation of the columns of Goll and Burdach, as will appear later in this description.

The second system ganglia consist of:

1. All the coalesced segments which form the spinal cord.
2. The medulla oblongata gray.
3. The gray masses in the pons Varolii.
4. The optic thalami and soft commissure.
5. The tuber cinereum.
6. The (doubtful) olfactory ganglion of Luys.
7. The caudate and lenticular nuclei of the corpora striata.

The hypophisis cerebri being the atrophied end of the cord, needs no numerical consideration.

Third System Ganglia.—Turning again to the Amphioxus, we find that the second system ganglia, or spinal cord, give off afferent and efferent nerves dorsally and ventrally, *without intervertebral ganglia, cerebellum, or anything resembling a cerebrum.* The "second pair" of nerves of the head end, instead of passing ventrally and dorsally, as do those of the lower segments, run backward or caudally; those which run from the tail to the head along the dorsum, are afferent, while those projected backward along the ventral portion of the body, are efferent.

These sets of nerves resemble strikingly in many particulars,

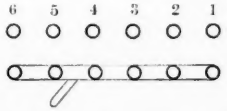
the pneumogastric nerves *and the lateral columns of the spinal cord* of higher Vertebrata. Confer ganglionic swellings upon all these afferent spinal nerves of the Amphioxus, proportioning their sizes to the nerve bundle sizes, and an appearance is presented like that which obtains in *Trigla adriatica*, a series of dorsal (intervertebral) ganglia from tail to head forming intervertebral ganglia, cerebellum, optic lobe (so-called cerebrum), and the higher series differ from the lower only in point of mass.

The crura cerebri and tegmental fibers thus become efferent and afferent nerves from the higher homologues of the central tubular gray; the corpora striata and optic thalamus, and these fibers with part of the restiform column project at different levels *from and to the spinal gray as peripheries* along the antero and postero-lateral columns of the cord. But this does not comprise *all* of the projection series from these parts for the cerebro-spinal nerves have their primary projections as well.

Morphology of the Third System Lobes.—The position of the cerebellum and its recognizable phylogenetic changes may be easily traced through the Vertebrata generally, but the lobes superior to it undergo a variety of distortions and changes of position, for the solution of which we must resort to schematic views.

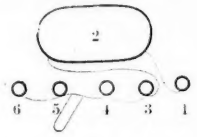
Given, a series of tubercles which shall from behind forward represent the lobes of the brain, as follows:

1. Posterior pair of tubercula quadrigemina.
2. Anterior pair of tubercula quadrigemina.
3. Epiphisis cerebri.
4. Mammillary eminence.
5. Olfactory lobe.
6. Cerebrum.

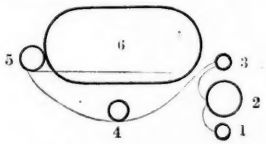


The gray secondary of each being united by commissures, the afferent and efferent. The first of these commissures it will be most convenient to follow through the developmental gyrations as apparently connecting the under surface of each lobe, but in reality connecting the secondary segments pertaining to each, as optic thalamus, tuber cinereum, olfactory ganglion and corpus striatum.

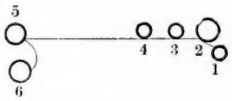
1 is connected to 2 and 3 by the upper end of the brachium conjunctivum, 3 to 4 by prolonged habenulæ, 4 to 5 by fornix, 5 to 6 by hippocampal fibers, tractus Lancisi and gyrus fornicatus (the latter principally). In the case of a fish with optic lobe (2) developed covering the other tubercles, the course of the commissures and relative mass appearance would be thus :



Bird, as pigeon, with cerebrum developed covering 1 to 5, the optic lobe being pressed to one side.

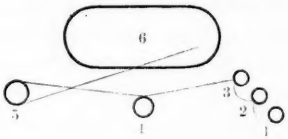


The following appears to be the arrangement of the brain of the fox shark, with lobes equally developed. I think the main mass must be the optic thalamus with the quadrigeminal bodies fused on its surface (this latter feature not represented here).

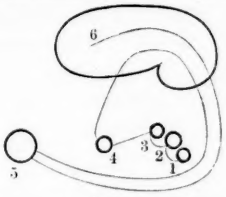


This form appears in the mammal with equally large olfactory lobe and cerebrum.

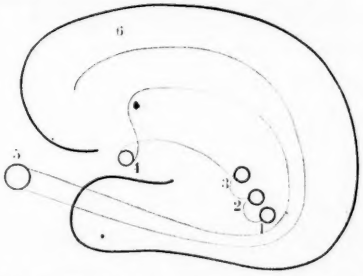
Evolution of the afferent longitudinal commissures, fissure of Sylvius and temporal lobe.—This condition is presented by an unconvoluted brain such as the beaver's, which is but faintly fissured.



An illustration of the gradual appearance of the Sylvian fissure with the hippocampal formation, is attempted below:



The last cut represents the Sylvian fissure formed as in man, with the accompanying fascicular distortions:



The growth of the frontal lobe in proportion to the intelligence of the primate individual, augments this creation of temporal. Many of the longitudinal sulci of the quadrumana fold over and under with this advancement of the occipital into temporal, and the parieto-occipital fissure on the median face of the cerebral hemisphere is doubtless created directly by this bend, and the calcarine may also owe its origin to this change. A variety of causes combine, however, in fissure formation, aside from those mentioned.

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THE BEE'S TONGUE, AND GLANDS CONNECTED WITH IT.

BY JUSTIN SPAULDING.

THE present paper is the outcome of an interest in the subject awakened by an article, by Mr. J. D. Hyatt, on the sting of the honey bee, in the *American Quarterly Microscopical Journal* for October, 1878, followed by one on the structure of the tongue by the same, July, 1879. Both bear impress of careful and painstaking interpretation of facts, and a genius in manipulation that is truly marvelous. Mr. Chamber's article, prior to Mr. Hyatt's

and which he criticises, I have not seen, and am indebted to Mr. Hyatt for what knowledge I possess of it. His article on the bee's sting, reading so like a fairy tale, incited me to attempt to demonstrate for myself if it was indeed the marvelous little structure described, and I can add my testimony (which he certainly does not need) to the literal accuracy of description, drawing and, as I believe, of his interpretation of the bee's manner of working it. That the bee can sting, every boy of ordinary enterprise can testify from personal experience, but Mr. Hyatt has spread before us the whole villainous apparatus, and initiates us into every motion, so that if one could be philosophical (under the circumstances a hard thing to do, even deacons are said to forget themselves and indulge in a mild form of profanity) the various stages of agony could be explained in learned terms, up to and including the final jab of the two blades, that leaves the victim to retire, swell up, and figure out his net gain from the operation. But to pass to the other end of the bee, which directly concerns us in this article.

My own observation, so far as the ligula is concerned, agrees with Prof. Cook's (see NATURALIST, April, 1880), and I think he has given the true solution when he says it consists of a sheath slit below, within which is the grooved rod, and projecting from the edges of the latter to the edges of the sheath, is a thin membrane, forming, as will be easily understood, when the rod is extended or thrown down, an enclosed sack, open only at the top. For the benefit of those who may still doubt as to this structure, I have drawn, under the camera, a very fine cross section of the ligula, kindly loaned me for the purpose by my friend, Mr. David Folsom. He has succeeded in cutting it from a specimen with the rod thrown out of the sheath (see Fig. 5).

In going over the work of Mr. Hyatt, while examining a mounted specimen of mouth parts, my friend, Mr. F. B. Doten, pointed out, in the mentum, a small spiral tube that gave me a clue, which followed up, has resulted, as I believe, in a slight addition to our knowledge of the parts. I am unable to find any mention of the glandular structure, a description of which follows. The drawing, No. 1, showing the head, is somewhat diagramatic; structures that might confuse being neglected. The specimen here represented was taken while fresh, pressed flat, dried under pressure, bleached in turpentine and mounted in damar.

It shows the structure as represented, from the tip of the ligula

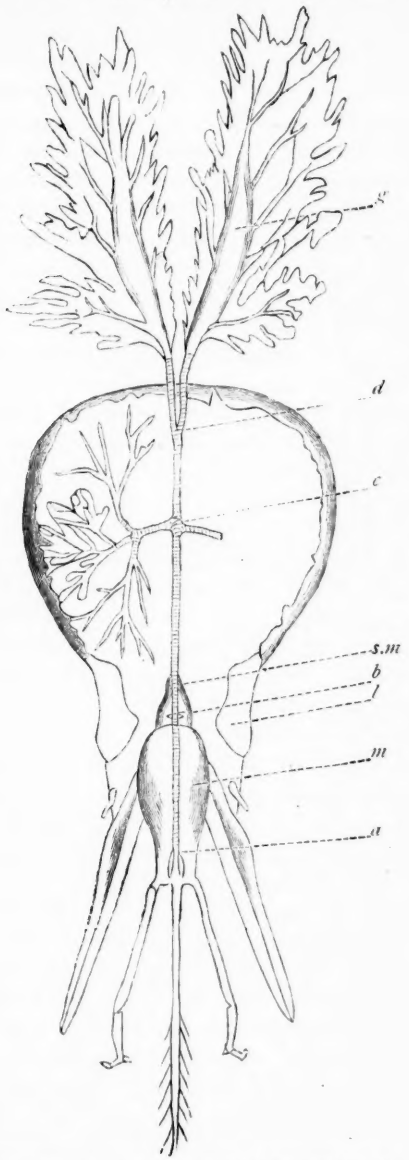

FIG. 1.—Diagramatic. *a*, point where spiral tube enlarges; *m*, mentum; *sm*, sub-mentum; *l*, mandibles; *b*, opening into mouth; *c*, entrance of ducts from head; *d*, junction of ducts from thorax; *g*, glands in thorax.

to the opening in the mouth at *b*. Beyond that I had to resort to dissection, not extremely difficult with a sharp scalpel, a steady hand and patience. It is best performed on alcoholic specimens, and the magnified drawing, under camera, of the gland from the thorax (see Fig. 3), it will be understood is somewhat shrunken on that account.

Running the scalpel from the base of one mandible back across close to the neck and forward to the other mandible, turn forward and pin, remove the brain and salivary glands; cut the œsophagus as far forward as possible, turn it back, and if all has been done carefully, one sees coming from the thorax the spiral ducts of two glands, which will be found, on following back, lying one on each

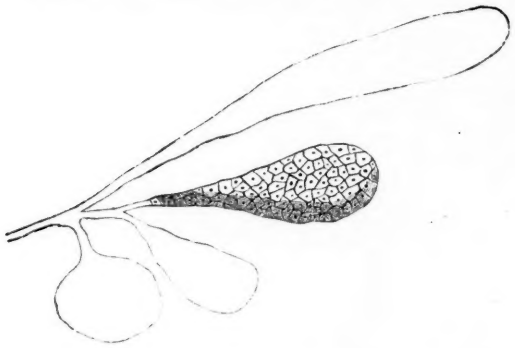

FIG. 2.—Fragment of glands of head much magnified.

side of the œsophagus, in the space between the muscles of the wings. I have given one of these, Fig. 3, magnified thirty-five diameters, as drawn under the camera. It could be but little more than outlined, as it was a dense mass of coiled and twisted glands, the true structure of which is shown (Fig. 4) still more magnified.

At the base, the duct enlarges, as is seen, into quite a reservoir. The ducts unite within the neck, or just as they enter the head, and following the floor of the latter, are joined by a pair coming in right and left (Fig. 1, *c*). Following up one of these side glands, we find it dividing into three main branches, ultimately terminating in glands, the structure of which is shown in Fig. 2 much enlarged. It will be seen that the glands from the thorax bear a striking resemblance to the Malpighian tubules of insects,

while those from the head are larger, different in shape, and composed of much smaller cells. Keeping to the floor of the head, the main duct passes on to the sub-mentum. Here on joining the spiral tube coming from the ligula, it passes by an opening common to both into the mouth at *b*, Fig. 1. Below the opening the spiral tube dips into the mentum, and is imbedded in its muscles.

FIG. 3.—One of the glands of the thorax, magnified thirty diameters.

At *a* (Fig. 1) it seems to terminate, judging from a side view, but a series of cross sections shows it to gradually widen from *a* (Fig. 1) to near the base of the ligula, where it terminates in a chamber that leads above into the sack, and below by a valvular opening into the groove in the rod. This trumpet-shaped part from (*a*) to the chamber at the base of the ligula, is collapsed, the upper half of the tube being pressed down into the lower half.

Thus we have a passage from the tip of the ligula through the groove in the rod, and the spiral tube in the mentum to the opening in front of the pharynx, above the labium and between the mandibles. This opening is transverse, and seems to have lips, and from its appearance we should expect it to close like a valve, if suction was applied below.

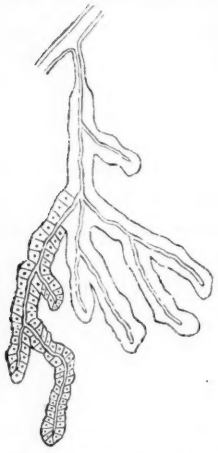

FIG. 4.—Fragment of glands of thorax much magnified.

Meeting this tube from the ligula, and discharging its contents through the same opening into the mouth, is the spiral duct from the glands of the head and thorax.

The questions are at once thrust upon us, whence comes this structure? and of what use is it to the bee? If I was wise the article would end here, but our inclination to explain everything by resorting to speculation, is always strong in the absence of facts to curb it. It seems but natural from the size, position and outlet of the glands, connected as they are with an inlet for the nectar of flowers, to conclude that they are organs that furnish the animal secretion that changes nectar into honey, and I would venture the suggestion that they may be the spinning glands of the larvæ modified. If this is true, I should expect to find them either in an active or aborted condition in nearly all Hymenoptera.

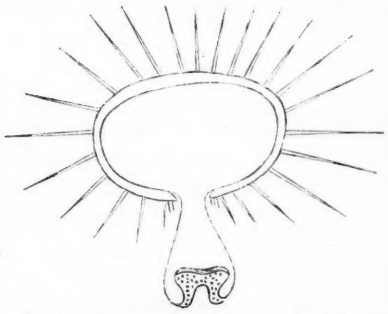

FIG. 5.—Cross section of ligula magnified one hundred and seventy diameters.

Another question raised, is, in what way is nectar carried from the flower to the mouth? This must be, from the nature of the case, largely a matter of speculation. Prof. Cook, in his article, says: "The tongue is also retracted and extended rythmically while the bee is sipping." May not this motion be due to a pumping action of the

grooved rod of the ligula, that enlarges and diminishes the size of the sack lying behind it? It would seem that the bee has perfect control of this rod, that it is remarkably elastic, and capable of much extension and contraction. The rod and sack thus acting as a suction and force pump, as will be easily understood by one familiar with the parts.

Of course I cannot say that the bee makes this use of it, but I do say it should, and if it does not, it is pure stupidity on its part. And if some one demonstrates that I am all wrong now, evolution, at no distant day, will set me right, for there will be born a bee, less conservative, that will dare defy old usages, and take a new departure; that bee, trust me, will make use of this cunningly-devised apparatus, and produce honey cheaper than any competitor, excepting the glucose man, and I hope and trust may worry even him.

——:o:——

HISTORY OF THE BUFFALO.

BY CAPT. WM. E. DOYLE.

THE early adventurers to the new world gave quaint and oftentimes exaggerated descriptions of the novelties they encountered, and the "monarch of the plains" met with a due share of notice at their hands, as will be seen from the subjoined extracts from their narratives.

The first account we have of the buffalo is given by the explorer Guzman, who saw herds of them in Cinaloa, New Spain (Mexico), in 1532.

In 1539 Father Marco de Nica, in his expedition in search of the famed kingdom of Cibola, says that in the kingdom of Ahacus (now in New Mexico) "they showed me a hide halfe as big againe as the hide of a great oxe, and told me that it was the skin of a beast which has but one horne upon his forehead, and that this horne bendeth towards his breast, and that out of the same goeth a point right forward, wherein he hath so great strength, that it will break anything how strong soever it may be, if he runne against it, and that there are great store of these beasts in that countery. The colour of the hide is of the colour of a great goat skinne, and the haire is a finger thick."

While De Sota was remaining at the town of Chiaha (now Rome, Ga.) in 1540, he detached Villabos and Silvera—two fear-

less soldiers—to explore the mountains to the north for gold. They returned July 9th, having found no gold, but mines of a highly colored copper used by the natives, who also gave them a hide which they supposed once covered a tremendous animal partaking of the qualities of the ox and the sheep, and much used by the natives, "which because the countrie was cold were very profitable, and served for coverlets because they were very soft and wooled like sheep. Not farre from thence towards the north were many oxen." Subsequently when at Pacaha—west of the Mississippi—De Sota sent thirty horsemen northward to explore the country. At a poor town at which they stopped, they were informed that the country above was very cold and there were such store of oxen that they could keep no maize for them, but that the Indians lived upon their flesh.

Alvar Nunez Cabeza, the treasurer of the ill-fated Narvaez expedition, wandering from Florida to Mexico with his three companions—1528 to 1532—saw immense herds of buffalo, and from his account of them in his Neufragios received the appendix to his name "de vaca" (of the cattle). In speaking of the section west of the Mississippi, he says: "In that country there were grey and black cows, with long hair, no bigger than those of Barbary, and their flesh coarser than Spanish beef."

In 1540, Coronado, in his celebrated expedition, first heard of buffalo at Cibola (Zuni), and says that the people: "travel eight days' journey, into certain plains lying towards the North sea. In this country are certain skins well dressed, and they dress them and paint them where they kill their oxen, for so they say themselves." He also saw an Indian there from another province who had a buffalo painted on his breast, and his chronicler, Castaneda, speaking of the hides, says they are "covered with a frizzled hair resembling wool." After the expedition left Cicuic (Pecos) he says: "All that way and the plains are as full of crooked backed oxen as the Mountain Serena in Spain is of sheep, but there is no people but such as keep those cattle."

Gomara gives the following description of the buffalo as seen by Coronado and his army: "Those oxen are of the bigness and color of our bulls, but their horns are not as great. They have a great bunch upon their fore shoulders, and more hair upon their fore part than on their hinder part, and it is like wool. They have great tufts of hair hanging down their foreheads, and it

seemeth they have beards, because of the great store of hair hanging down at their chins and throats. The males have very long tails, and a great knob or flock at the end, so that in some respects they resemble the lion and in some others the camel. They push with their horns, they run, they overtake and kill a horse when they are in their rage and anger. Finally it is a fierce beast of countenance and form of body. The horses fled from them, either because of their deformed shape or else because they had never seen them before. Their masters have no other riches or substance; of them they eat, they drink, they apparel, they shoe themselves; and of their hides they make many things, as houses, shoes, apparel and ropes; of their bones they make bodkins; of their sinews and hair, thread; of their horns, maws and bladders, vessels; of their dung, fire; and of their calf skins, budgets wherein they draw and keep water. To be short they make so many things of them as they have need of, or as may suffice them in the use of this life."

In 1585 Espejo, returning from his exploration of Northern New Spain, says that he traveled down a river "called Rio de las Vacas (that is to say the River of Oxen, now the Pecos, in Texas) in respect of the great multitude of oxen or kine that fed upon the banks thereof, by the which they travelled for the space of 120 leagues—still meeting with store of the said cattell."

Sir Humphrey Gilbert, whose voyages commenced in 1583, says there are in Newfoundland, "buttolfes, or a beast, it seemeth by the tract and foot very large in maner of an oxe," and in a work published by Hakluyt in London (1589), it is stated that in the island of Newfoundland were found "mightie beastes like to camels in greatnesse and their feete were cloven. I did see them farre off, not able to discerne them perfectly, but their steps shewed that their feete were cloven and bigger than the feete of camels. I suppose them to be a kind of Buffes, which I read to bee in the countreys adjacent, and very many in the forine land."

Another author, Purchas, says that as early as 1613 the adventurers in Virginia discovered a "slow kinde of cattel as bigge as kine, which were good meate."

A work published at Amsterdam in 1637, by Thomas Morton, called "New English Canaan," contains the following: "The Indians have also made description of great heards of well grown beasts, that live about the parts of this lake (Erocoise) such as

the christian world (until this discovery) hath not bin made acquainted with. These beasts are of the bigness of a cowe, their flesh being very good foode, their hide good leather; their fleeces very useful, being a kind of woole, as fine almost as the woole of the beaver, and the salvages do make garments thereof. It is tenne yeares since first the relation of these things came to the eares of the English."

Joliet and Marquette, descending the Mississippi in 1673, saw immense herds of buffalo, and the latter thus discourses of them: "We call them wild cattle, because they are like our domestic cattle, they are not longer, but almost as big again, and more corpulent; our men having killed one, three of us had considererable trouble in moving it. The head is very large, the forehead flat and a foot and a-half broad between the horns, which are exactly like our cattle, except that they are black and much larger. Under the neck there is a kind of large crop hanging down, and on the back a pretty high hump. The whole head, the neck, and part of the shoulders, are covered with a great mane like a horses; it is at least a foot long, which renders them hideous, and falling over their eyes prevents their seeing before them. The rest of the body is covered with a coarse curly hair like the wool of our sheep, but much stronger and thicker. It falls in summer, and the skin is then as soft as velvet. At this time the Indians employ the skins to make beautiful robes, which they paint of various colors."

The first engraving of the buffalo appeared in the first edition of Father Hennepin's travels.

Jontel in 1685 saw buffalo at Bay St. Bernards, and the same year La Salle's party found them on a river in Texas which they named La Vaca, from that circumstance Charlevoix in one part of his works calls them "Illinois cattle." In 1756 some of those who settled in the Abbeville district of South Carolina found buffalo there, and in 1774 Bernard Roman speaks of them as a "benefit of nature conferred on Florida." In 1769 Daniel Boone and Finley found them in small numbers in the valleys near the Cumberland mountains, but came across a large herd in a valley at the west foot of the Alleghany mountains. Boone remarked to his companion: "Job of Uz had not larger droves of cattle than we." Father Venezas does not include the buffalo among the animals of California, neither Harmon nor Mackenzie speak

of them as being in New Caledonia, and Du Pratz says they did not exist in Lower Louisiana.

In the last century the trade in buffalo wool became brisk, and numerous factories were established for its manufacture into cloth.

The buffalo roamed in small herds all over the country before the advent of the white man, but only on the plains were those immense herds, so often described, ever seen. The prairie was its favorite resort. The railroads and settlements have, however, broken these herds into small bodies, and the unrestrained slaughter of buffalo in the past few years has so reduced their numbers that their extinction is a question of a very short time.

Buffalo make good tractable work cattle when caught young, and the *Bois Brules* frequently use them as such.

White buffalo have frequently been seen and killed. All the Indian tribes regard them as "big medicine" but they have different superstitions regarding them. For instance, Catlin, the painter, while among the Mandans in 1832, saw a white buffalo robe erected on a pole in their village as a sacrifice to the great spirit. It had been purchased from the Blackfeet, who killed the buffalo, for eight horses and a quantity of goods. On the other hand the Comanches believe it very dangerous to see a white buffalo. In 1869 I saw a young Comanche, who had seen a white buffalo, return to his camp almost dead with fear. He was taken into his tent, the medicine men were sent for, and they smoked him and kept up incantations over him day and night for a week. When he came out he believed that he had a very narrow escape from death. In 1869 a white buffalo was killed by a white man on the north fork of the Red river, I. T., and the hide presented to Gen. Grierson. He desired to have it dressed to preserve it, but failed to get any Indian to undertake the task for a long time. At last he prevailed on a Comanche chief named "Horseback" to have the operation performed. "Horseback" selected one of his squaws, had the "medicine men" of his band go through various ceremonies over her to preserve her life, and then placed her in a teepee some distance from his camp, where the hide was taken to her by a soldier and brought away by him when dressed. No other Indian would look at the hide, much less touch it. Her food was left for her at some distance from her teepee, and when the robe was dressed, "medicine" ceremonies were held over her before she was allowed to rejoin the

camp. I twitted "Horseback" about the fear of the robe, calling his attention to the fact that no harm befell any of the white men who handled the robe, but he answered that such might be the case, but what was "bad medicine" for a Comanche might be "good medicine" for a white man, and *vice versa*. He proposed to take no risks in the matter.

A white buffalo (stuffed) was on exhibition at the Centennial Exposition, the property of R. M. Wright, of Kansas, and it is a pity that it was not secured by the Smithsonian or some other institution for preservation.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— The tariff laws of the United States are in some respects a direct tax on intellectual progress, and although it is not unlikely that this result is entirely due to oversight on the part of the framers of those laws, the consequences are none the less injurious. Some of our contemporaries doubtless remember the difficulties experienced by Alvan Clark & Sons, of Cambridge, in procuring unwrought optical glass, for use in building the telescopes for which their house is so highly esteemed. The high tariff on these rough discs operated as a prohibition to the manufacture of the optical instruments to which they are necessary. This result was probably not anticipated by our legislators. After prolonged negotiations, special dispensations from the Treasury Department have permitted the discs to pass free if for schools, colleges or academies, otherwise a duty of 10 p. c. is exacted.

The law with regard to "specimens of Natural History," that is, those relating to botany, zoölogy, palæontology, geology and mineralogy, imposes a heavy duty on them when they are intended for sale, or are not designed for exhibition in a public institution. As the greater number of specimens of this kind are obtained by persons who depend on their sale for reïmbursement, it is evident that students in this country must pay the tax, or go without them. The actual result is, that students and institutions being mostly poor, do not purchase, and sellers must pocket the loss. So well known has this become, that such objects nearly all now go to Europe, to the impoverishment of science here, and

the great enlargement of the facilities for study abroad. In spite of considerable self-praise, the poverty of most of our museums is marked, and in proportion to our population and resources, their number is probably smaller than in any other civilized nation.

Precisely why congressmen should wish to tax bottled frogs and snakes we cannot clearly understand. It is true that these animals have a market value as food for man, but our government does not tax foreign meat or bread-stuffs. Nor has any one of our legislators announced his intention of fencing in a tract to be used as pasture for boas and anacondas, for it is generally believed that the breeding of these animals, though profitable, is not practicable in this country, owing to the antipathy to them of certain American citizens of foreign birth. Nor is there any fear of a dangerous foreign competition with their natural production here; for although we were once informed by a Virginian mountaineer, that both "the Bowling constrictor, and the Africanstrictor" were found in his neighborhood, we afterwards learned that he had been led into error by confiding too implicitly in the representations of a traveling showman.

We may, however, be wrong in all this, for we have lately been taught by our rulers that a live hippopotamoid is merchandise. A specimen of the small hippopotamus-like *Chœropsis liberiensis*, having been imported from West Africa by Mr. Forepaugh for the instruction of American citizens, it became necessary to restrain this pandering to a corrupt taste, by imposing the duty *ad valorem*. It was hoped by the officers of the United States, that the beast had been obtained on the east coast of Africa, so that they might be enabled to levy 30 p. c. duty. But Mr. Forepaugh unpatriotically called on Professor Leidy, who swore (and so do we) that the animal was derived from the west coast; so the Government could only collect 20 p. c.! Dr. Leidy also swore (and so do we) that it was a *Chœropsis* and not a *Hippopotamus*, but Mr. Forepaugh could not get any reduction on this account. And this in spite of the argument urged with much force, that although the Hippopotamus manufactories along the Delaware and Mississippi would certainly be ruined by the introduction into the country of a *Hippopotamus* free of duty, there had not been as yet a single establishment for the production of *Chœropses* set up within the limits of the United States.

We had almost overlooked one remarkable effect of the tariff on collections of foreign fossils. The home industry in fossil bones has been so stimulated, that like our cotton goods in China, and our cutlery in Australia and Sheffield, our fossils are assuming a front rank in the markets of the old world, once the sole producers. And from still another stand-point, if some unwise legislator does not remove the duty all too soon, we shall undoubtedly have a greater home production of fossils in all that relates to knowledge of the laws of nature than any nation on the globe.

not excepting the Indian and the negro. And we shall ultimately have the proud satisfaction of engraving on the tomb of science in this country, "*De mortuis nil nisi bonum.*"

—— The Governor of Pennsylvania refers to the Geological Survey of the State, in his late message to the Legislature, in the following language:

"The Second Geological Survey of the State is progressing as fast as the appropriations will permit. This is a work which, if not well done, should not be done at all. It must possess the utmost scientific accuracy. Its treatment of soils and minerals, their location and distribution, must be the result of painstaking work, done on the ground. Its surveys and alignments must show the actual facts, and be made from actual measurements. This is precisely the way in which this great and important work is being done. It is in the hands of a board who understand fully the value of the duty in hand, under the superintendence, as State Geologist, of J. Peter Lesley, Esq., whose attainments and qualifications are unquestioned. So far forty-four reports of this work have been published, and sixteen reports are in preparation. These reports have justly attracted the highest attention everywhere. Forty-two counties have been surveyed in full, eighteen in part, and seven not at all. These seven are Columbia, Luzerne, Lackawanna, Pike, Schuylkill, Berks, and Carbon. They embrace the anthracite coal region of the State, and have been reserved that the work upon them may be made continuous and exhaustive. In a scientific and commercial point of view the surveys to be done in them will possess the highest value. It will be expedient to make the appropriations to continue this work in accordance with the views of the board controlling the Second Geological Survey."

The recommendations of the Governor as thus expressed, are doubtless seconded by every friend of intellectual and material progress in the Commonwealth. The Geological Survey of Pennsylvania has added, and will add important contributions to the knowledge of the laws of nature as exhibited in all the aspects of creation. Such are the chemical conditions of the primitive world; the forces which have distorted its crust; and the experiences and progress of ever present life, vegetable and animal, under these laws. It is of great importance to the educational interests of the country that the State governments should place before their people statements of the history of the regions which they represent. Such histories express in their highest aspect, the laws of life; and to the importance of a knowledge of these, no one can be insensible. The economic side of a geological survey is, however, more generally appreciated, for it is evident that an inventory of her possessions is most desirable for a State to possess. It is especially so to a State like Pennsylvania, where so large a part of the population is directly or indirectly dependent on the contents of the rock strata for their livelihood.

RECENT LITERATURE.

REPORT OF THE COMMISSIONER OF FISH AND FISHERIES FOR 1878.[1]—This bulky volume is a valuable contribution to applied zoölogy, a subject in which the United States is, happily, nearly if not quite on a par with France or Germany, if not excelling those countries. The times are now ripe for the people of this country to receive from scientific men the fruits of the application of the scientific knowledge which has been stored up in museums and libraries; and fortunately this process, as seen by the work of the U. S. Fish Commission, in the end aids in the true development of science. From "skin and bone" zoölogy, preserved fish, trays of labeled fish-bones and "species work," to the study of the habits of fishes, their distribution in geographical extension and in vertical range, their relations to one another, and to the world of invertebrate animals on which they rely for subsistence, their embryology, their relations to the physics of the sea—these are questions of abstruse and philosophic import, as well as of purely practical, economic moment. Thus in fish-breeding as in star-gazing or gas-making, the solution of the deepest problems of science go hand in hand with the commonest, most trivial operations and needs of our everyday life. And human life has now become so composite and differentiated, our population is growing so dense, and the means of living for the masses so much more precarious, that what is now wasted must eventually be converted into wealth, and the practical application of science must be brought to bear in the solution of these economic problems.

The report before us is a due commingling of purely scientific research with practical essays on fish-breeding and fisheries. The discovery of new food-fishes; the best and speediest means of propagating and restocking our coast and inland waters, the mechanical contrivances, nets and apparatus for hatching, and similar subjects, with voluminous extracts from, and translations of, European articles, are presented in this as in former volumes. With such practical matter is combined some excellent work in pure zoölogy, viz.: a report on the marine Isopoda of New England and adjacent waters, by Oscar Harger, with thirteen well executed plates; and a report on the Pycnogonida of New England and adjacent waters, by Edmund B. Wilson, with seven plates. These papers will be noticed elsewhere in this journal.

Professor Baird concludes his report with the suggestion that as a possible result of the application of steam to fish-hatching apparatus, we may be able to so multiply the number of our cod, mackerel, herring and halibut, "as to obviate the necessity in the

[1] *United States Commission of Fish and Fisheries.* Part VI. Report of the Commissioner for 1878. A. Inquiry into the Decrease of Food-fishes. B. The Propagation of Food-fishes in the waters of the United States. Washington, 1880. 8vo, pp. 988.

future of asking a participation in the inshore fisheries of the British provinces, and thus enable us to dispense with fishery treaties or fishery relations of any kind with the British or other governments."

HORN'S SYNOPSIS OF THE BURYING BEETLES OF THE UNITED STATES.[1]—Although this essay is modestly called a "Synopsis," it is much more than that, as the characters of the family and its sub-divisions, of every species and genius, are given with sufficient fullness, and moreover the common species which were described years ago are re-described. This is an excellent feature, because in synopses of different groups of insects it is usually the case that the species already described are mentioned only by name, and to the beginner it is difficult to learn what are really the common species briefly and imperfectly described in the often inaccessible works of Linnæus, Fabricius, Olivier, Dejean and others. Another excellent feature of the essay is that the author has himself given excellent figures in outline of all known genera (with few exceptions), nearly all of which have been drawn by himself from nature.

Dr Horn has made some changes in the limits of the group, and all the foreign genera have been included in the study and mentioned in the generic tables, though not described. The family is an interesting one, as it includes the true burying beetles, and also a good proportion of the cave beetle of Europe and America. It is interesting to trace, as Dr. Horn has done, the relationship of our *Adelops* of the Mammoth Cave to the out-of-door forms, and to see, a point not however noticed by the author, that Adelops simply differs from its out-of-door allies of the genus Ptomaphagus in the small eyes, and longer, slenderer antennæ, and other slight characters, so as to lead our author to say that Adelops "is closely allied to Ptomaphagus and I am in doubt whether it should be retained as distinct." We should reason from this that *Adelops hirtus* was originally derived from some out-of-door species of Ptomaphagus which had got into the cave and been modified by its cave-life into its present form. The main results of a cave life are the impairment or actual loss of the eyes, and to compensate for this the elongation of the antennæ, which probably renders the sense of touch, and possibly of smell, more acute. This also adds another to the cases which almost demonstrate that all the cave animals have originated from out-of-door forms.

In conclusion we may express the hope that the recent labors of Drs. LeConte and Horn, may enable them ere many years to prepare a compact manual of our United States Coleoptera, a consummation most devoutly to be wished. With fair compendiums

[1] Synopsis of the Silphidæ of the United States with reference to the genera of other countries. By GEO. H. HORN, M.D. From the transactions of the American Entomological Society. Philadelphia, 1880. 8°, pp. 219–320. 3 plates.

of our native bees, wasps, flies, beetles, butterflies and moths, bugs and grasshoppers and Neuroptera, an immense impetus would be given to the study of entomology. As it is, we fear that the twentieth century will be far advanced before these desirable works will be published.

ROBINSON'S FLORA OF ESSEX COUNTY, MASSACHUSETTS.[1]—Essex county enjoys the distinction of being at an early date one of the botanical centers of the United States, as it was the home of Dr. Manasseh Cutler, Dr. George Osgood, Dr. Andrew Nichols, Dr. Charles Pickering and, more particularly, of William Oakes, to whose memory the genus *Oakesia* has recently been dedicated by Mr. Sereno Watson. The names also of Rev. John L. Russell and Mr. Geo. D. Phippen, Mr. S. B. Buttick, and of others, should be mentioned; while Mr. C. M. Tracy, in his Flora of Lynn, was the first to publish a list of Essex county plants. These and other facts are related by our author in the historical introduction to his Flora. It appears that originally almost the only extended collection of dried Essex county plants were those of the late Mr. Oakes, but the list before us is based upon the herbarium recently collected by Mr. Robinson, and nearly all of which is represented in that of the Peabody Academy of Science, at Salem. The notes under the specific names are quite full and interesting as regards the flowering plants; the enumeration of mosses and thallophytes, in which the author was assisted by other botanists, is less complete. We would like to have seen a more detailed bibliograpy, *i. e.*, the titles given in full, with complete references to articles by the earlier botanists, of which the titles and dates are not always given; only the name, without the date, of the magazines or transactions containing them. But this is a minor blemish. The undertaking has been well carried out, the volume is a handsome one, and it will be a *vade mecum* to the herbalist of eastern New England.

REPORT OF THE COMMITTEE OF THE FRANKLIN INSTITUTE ON ANALYSES OF INKS.—A committee of the Franklin Institute was appointed by a vote of that body at its November meeting, for the purpose of examining into the truth of certain statements made and the value of certain tests proposed for the detection of iron in inks. The object of the appointment was stated to be that during the interval of time which should elapse between now and the legal remedy of the expert abuse in court, an extra judicial court might criticise all statements professing to be scientific and the fear of reversal before their peers might be an additional security for the value of expert statements.

The committee resolves "that inasmuch as the methods for the "detection of iron in inks and for the identification of inks are "described in numerous and well-known works on chemistry; "and inasmuch as the chemical expert testimony in the Whittaker

[1] The Flora of Essex county, Massachusetts. JOHN ROBINSON, Salem. Essex Institute, 1880. 8° pp. 200.

"will case contains nothing new of scientific interest, your com-
"mittee beg to be relieved of further consideration of the subject.
"Resolved, That we call the attention of the Franklin Institute to
"the numerous objections to which expert investigations are
"open, when undertaken as at present by parties securing the ser-
"vices and interested in the decision of the court, and we earn-
"estly recommend that the Franklin Institute takes such action
"that the change from the present plan may become a subject of
"legal enactment." The signers of this remarkable production are Dr. W. H. Greene, Dr. Geo. A. Koenig, Dr. Wm. H. Wahl, Mr. Moody, Mr. Pemberton, Sr., and Dr. Isaac Norris.

The humorous points of this report cannot be better appreciated than by comparing it with the statements of some of those experts whose testimony the committee was to examine. Compare the first "inasmuch" with this by the ex-President of the Franklin Institute, Prof. R. E. Rogers: "I don't recall in any of our chemical books a direction for examining writing for iron. I do not know a single authority" (Wed., April 14, 1880, 54th day, p. 6469). Dr. Genth says: "I do not believe anybody has ever made any experiment in that direction" (*i. e.*, the conditions under which potassium ferrocyanide and sulphuric acid react on each other). The second "inasmuch" is equally opposed to the testimony.

Committee's Report.—"And inasmuch as the chemical expert testimony in the Whittaker Will case contains nothing new of scientific interest—."

Dr. Rogers.—"It has been entirely overlooked by the writers of the text books that these reagents" (*i. e.*, potassium ferrocyanide and potassium sulphocyanide.) "are not sufficiently refined for the nice determination of the presence or absence of iron" (p. 6420).

—"There may be writing which contains iron that * * tested for iron by the method which has been adopted will fail to show the presence of iron" (6430).

—The "fire test" devised by Dr. Rogers for determining iron in inks and pronounced the "most rigorous" (p. 6438-9).

Mr. Johnson.—"Professor, is the fire test stated in the books?" "No, sir." "Then it is a result from your own original experimenting?" "Yes, sir" (p. 6470).

—*Mr. Johnson.*—"But they do see that there is a blue, the result of the mixture?"

Dr. Rogers.—"Of what?"

Mr. Johnson.—"Of the sulphuric acid and ferrocyanide of potassium."

Dr. Rogers.—"No, they do not. I don't think such a thing has been observed generally."

Mr. J.—"When you put them in one bottle, how can you avoid it?"

Dr. Rogers.—"They are not put in one bottle."

Mr. J.—"Suppose they are."

Dr. R.—"I have never known them to be put in one bottle, except instances in which I have done it" (p. 6497).

It will sufficiently appear from the above that either the distinguished representatives of chemistry in the University of Pennsylvania and the Jefferson College are mistaken or else great chemical discoveries have been the result of the Whittaker will trial. The advice of the committee does not seem to be *apropos* to anything; as its reason for not undertaking the duty assigned to it, viz.: that the duty would not be profitable, seems to be gratuitous. The whole report is a very good illustration of "how not to do it."—*Persifor Frazer.*

OUTLINES OF LINGUISTIC SCIENCE.[1]—In what has appeared of the second volume of his "outline of linguistic science," the celebrated Austrian linguist has given to the world a series of short, but lucid sketches of the languages of Eastern Siberia, not belonging to the Ural-Altaic family; of Ale-ut, Eskimo and also of the whole Malay-Polynesian family scattered over the whole Pacific ocean. The languages of Western and Southern Africa was disposed of in the first volume, and in one of the next numbers the author will reach the American languages.

MOLINA'S DICTIONARY OF THE AZTEC LANGUAGE.[2]—This work is a most praiseworthy republication of the second edition of Molina (1571), the only copious dictionary which exists on the Aztec language. To students, who were almost discouraged by the high price of the original, this republication is now offered at a moderate figure (50 marks in Leipzig, unbound) and will enable them to study the sonorous Aztec tongue from the best authority in existence. The volume contains over 50,000 terms.

RECENT BOOKS AND PAMPHLETS.—Sur l'uniformité de la Nomenclature Géologique dans tous les pays, en ce qui regarde les Terrains et les Etages. (Ext. du Compte Rendu Sténographique du Congrès International de Géologique, 1878.) Par M. Stéphanesco. 8vo, pp. 4, 1880. From the author.

Some Copper Deposits of Carroll county, Maryland. By Persifor Frazer. 8vo, pp. 8. Maps 1, 1880. From the author.

Extraits de Géologique pour les années 1877 et 1878. (Ext. des Ann. des Mines, 1880.) Par MM. Delesse et de Lapparent. 8vo, pp. 242. Paris, 1880. From the authors.

The Food of Fishes. (From Bull. No. 3, Ill. State Lab. Nat. Hist., November, 1880.) By S. A. Forbes. 8vo, pp. 61. From the author.

Annual Report of the Secretary of the Interior on the operations of the department for the year ending June 30, 1880. 8vo, pp. 81. From the department.

Drug Adulterations. By S. V. Clevenger. (From the Druggist for December, 1880.) pp. 7. From the author.

Cerebral Anatomy Simplified by Comparative Anatomy Studies by S. V. Clevenger. (From the Chicago Med. Journ. and Examiner for November, 1880.) 8vo, pp. 9. From the author.

Erster Nachtrag zum Katalog der herpetologischen Sammlung des Basler Museums. Von F. Müller. 8vo, pp. 49, pl. 1. 1880. From the author.

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[1] *Dr. Friedr. Müller, Grundriss der Sprachwissenschaft.* Vol. II, No. 1ª. 2ª. Wien. 1880. 8°. A. Flölder, publisher.

[2] Vocabulario de la lengua Mexicana, compuesto por el P. Fr. *Alonso de Molina;* publicado de nuevo por Julio Platzmann. Edicion facso'milaria. Leipzig, B. G. Teubner. 1880. 4°. Parte I. Castell.-Mexic. 121 double pages. Parte II. Mexic.-Castell. 162 double pages, of two columns each.

Expedition Geológica por la Provincia de Toledo en 1877, por D. de Cortázar. Madrid. 8vo, pp. 7. Maps 1. From the author.

Memoria acerca de la Exposicion Universal de Filadelfia en 1876, por D. de Cortázar, Madrid. 8vo, pp. 420, 1 map. From the author.

United States Commission of Fish and Fisheries. Report for 1878. 8vo, pp. 988, plates 36. Washington, 1880. From the commissioner.

Observations Générales sur la Famille des Scincoidiens por M. Bocourt. (Ext. de la Zool. de Mex., 3e partie.) Folio. pp. 7, pls. 2. From the author.

A structural Feature, hitherto unknown among Echinodermata, found in Deep Sea Ophiuraus. By Theodore Lyman. (From Anniv. Mem. Boston Soc. Nat. Hist.) 4to, pp. 12, pls. 2. Boston, 1880. From the author.

Beiträge zur Paläontologie von Österreich-Ungarn und den Angrenzenden Gebieten. Herausgegeben von E. v. Mojsisovics und M. Neumayr. 4to, pp. 71, pls. 8. From the editors.

Illustrations of Nests and Eggs of Birds of the United States, with text. By Thomas G. Gentry. 4to, pls. 3 and 4. Philadelphia, 1880–'81. From the author.

——:o:——

GENERAL NOTES.

BOTANY.[1]

THE FUNGI WHICH PRODUCE MILDEW ON COTTON GOODS.—In a recent English work upon "Sizing and Mildew in Cotton Goods," by G. E. Davis, Charles Dreyfus and Philip Holland, the following fungi are enumerated as found growing on cotton goods and in analogous situations, viz: *Stachybotrys lobulata, Stachybotrys atra, Penicillium sitophilum, Myxotrichum deflexum, Polyactis fasciculatis, Sporocybe alternata, Rhopalomyces pallidus, Papulaspora sepedonioides, Acremonium alternatum, Ascophora mucedo, Penicillium chartarum, Penicillium crustaceum, Aspergillus glaucus, Aspergillus roseus, Periconia glaucocephala, Cladosporium herbarum, Chætomium chartarum, Ascotricha chartarum, Orbicula cyclospora, Alographum maculare, Diplodia cowdellii, Sphæropsis* sp., *Ascobolus saccharinus, Typhula gyrans, Arcyria ochroleuca, Perisporium vulgare.* Of these the authors say, "the above have all been found on decaying vegetable fibers, the most common being *Cladosporium herbarum, Penicillium crustaceum,* and Sporocybe, with two species of Aspergillus. The fungus giving a reddish hue to stale rice paste is known as *Papulaspora sepedonioides,* whilst *Diplodia cowdellii* is the cause of black spots on damp cotton. We have noticed others in our experiments, notably *Macrosporium cheiranthi, Rhinotrichum lanosum, Myxotrichum chartarum, Mucor phycomyces* and *Mucor mucedo,* but we hesitate in placing these species as being nominally found in cotton goods."

Further on the authors say, "The colored stain which first attracts the eye when examining a specimen of mildewed cloth, is due possibly to the mycelium, or it may arise from the fructification of a fungus; or, again, organic colors produced by the decomposition of a nitrogenous substance, or carbo-hydrate in the matrix may be the cause of it. When nitrogenous substances

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

are present in a pabulum, though in small quantity only, the mildew usually commences to be visible to the naked eye as minute yellow spots. These, as we have just said, may be caused by the growth of the mycelium, which in providing nourishment for itself and for the subsequent fructification of the fungus, brings about a decomposition of the nitrogenous materials, and gives rise to crenic and other organic acids. At a more advanced stage, humic and ulmic acids are produced, the fiber of the cloth becoming at the same time perceptibly more tender. It has been said that mildew may exist on the sizing only of a fabric. We are inclined to doubt this, for in our experience the mycelial threads have never been confined to the surface size alone, but could always be traced ramifying amongst the cotton filaments. If the size alone of a cloth were smitten with mildew, the cloth itself would not be tendered, unless the acids we have mentioned were a sufficient cause, which is not so. We believe it impossible for mildew to be present in such amount as to be clearly visible to the eye without a penetration of the mycelium to the textile substratum, and should expect a suitable magnification and illumination of the object to reveal the fact."

As to the colors of mildews, according to the authors, yellow patches on cloth are mostly due to the presence of crenic acid, although very rarely they proceed directly from the fungus, *Penicillium sitophilum;* green mildew is nearly always due to the fructification of *Penicillium crustaceum;* and dark-green or greenish-gray mildew is owing to the fructification of a Penicillium or Aspergillus, or to the mycelium of a species of the Dematiei. Brown mildew may be due to the presence of apocrenic acid, or of one or more of many fungi. Red patches appear to be due to fungi; those mentioned by the authors being a species of *Epicoccum, Aspergillus roseus,* and *Papulaspora sepedonioides.*

Allen's Characeæ Americanæ Exsiccatæ.—We have had the pleasure of examining Part 1 of this important distribution of curious and little known plants. It includes three species of Nitella, and seven species and varieties of Chara. The specimens are of generous size, and are in excellent condition for study. The more interesting species are *Nitella intermedia,* a new one, described by Nordstedt; *N. megacarpa,* a new species now first described as such by Allen; *Chara sejuncta* A. Br., *C. gymnopus* A. Br., var. *Michauxii* A. Br., a gigantic species, and *C. hydropitys* A. Br., var. *septentrionalis.* The variety last named is described by Nordstedt, and is the same plant which Dr. Halsted described as a new species under the name of *C. Robbinsii* in the Proceedings of the Boston Society of Natural History, xx, 1879. *Nitella megacarpa* Allen, is the same as *N. intricata* Ag., in Halsted's paper; it is of very large size, and compared with the diminutive *N. tenuissima* is a giant indeed.

The publication of sets of specimens like these cannot fail to

stimulate a search for these interesting plants by American botanists, and it is to be hoped that during the coming season all collectors who can do so will render what service they can by gathering abundant specimens and forwarding them to Dr. Allen, at 10 East 36th street, New York. There are few localities in which half a dozen or more species cannot be found. We are informed that the author has already material for forty or fifty species or clearly marked varieties, and is confident that the number will eventually reach seventy-five.—*C. E. B.*

THE PEPPERIDGE TREE IN MAINE.—Our attention has been called by Professor G. H. Stone of Kent's Hill, Maine, to the fact that the pepperidge or tupelo *(Nyssa multiflora)* is a native of Maine, although neither Gray nor Wood so state in their manuals. It is given as one of the trees of the State in the "Portland Catalogue of Maine Plants, 1867," and according to Dr. Goodale, was found at Winthrop and Waterville, by the late Dr. Holmes. Professor Stone sends specimens from Kent's Hill, Kennebec county. The importance of this note lies in the fact that Vasey, in his "Catalogue of the Forest Trees of the United States," gives its range as "from Massachusetts to Illinois, and Southward," while Sargent, in his preliminary "Catalogue of the Forest Trees of North America," gives it as from "West Milton, Vermont, South to Florida; West to Michigan, Missouri and Arkansas."—*C. E. B.*

HISTOLOGY OF THE PUMPKIN STEM.—Professor J. C. Arthur has been studying the stem of the pumpkin, and in an article in the *Botanical Gazette* sums up the tissues as follows:

Epidermal System:
- Epidermis.
- Stomata.
- Hairs.

Fundamental System:
- Interfascicular parenchyma.
- Hypodemia.
  - Cortical wood.
  - Cortical parenchyma.
  - Collenchyma.

Fibro-vascular System:
- (Cambium.)
- Phloem.
  - Sieve-tubes.
  - Phloem parenchyma.
- Xylem.
  - Vessels.
    - Annular.
    - Spiral.
    - Reticulated.
    - Scalariform.
    - Pitted.
  - Wood parenchyma.

Professor Arthur directs attention to the value of the pumpkin-stem for use in the instruction of classes in the Botanical Laboratory, furnishing, as it does, so many examples of the tissues of the higher plants. We can also testify to its value, having used it for many years for the purpose recommended. We always secure every autumn several feet of stems, which we cut up and preserve in jars of alcohol, for future use in the laboratory.

FERTILIZATION OF AQUILEGIA.—The species of Aquilegia to which I referred, and on which Mr. Trelease comments, have nectaries of 40 millimetres long; while 21 is the longest bees-

tongue as he believes. But the species I noted have curved nectaries, which it would probably try the patience of a busy bee to course, even if the tongue were long enough. Moreover if my observations are worth any thing, Aquilegias hereabouts are cross-fertilized by pollen-hunting insects. It may be that honey bearers cross-fertilize them sometimes, for one man cannot see everything; but I have never seen a case. If this be the fact, as I believe it to be, the arrangement of the nectarium in the case is superfluous.—*Thomas Meehan.*

THE EDITOR of this department has in preparation for the NATURALIST a sketch of the Progress of Botany in the United States in the year 1880, and solicits copies of papers and other publications made during the year, together with such other information as will make the account as full and accurate as possible.

BOTANICAL NOTES.—A good many years ago DeBary suggested the animal nature of the slime moulds (Myxomycetes), and was very severely criticised for doing so, the naturalists of that day feeling bound to maintain the old dogma of the absolute distinctness of the animal and vegetable kingdoms. Now, however, any one at all familiar with the Monera and the slime moulds cannot fail to see the remarkable similarity between the organisms which, on the one hand, are called animals, and on the other, plants. This has led W. Saville Kent, in his recently published work on "Infusoria," to take strong ground in favor of regarding them as animals. M. C. Cooke, in *Grevillea* for December, rather impatiently takes the learned author to task for his boldness. After all, what is the use of quarreling over a matter like this? The position of the slime moulds in the great kingdom of life, is the same whether we draw our imaginary bisecting line on this or that side of them.—— The temper of the discussion of the foregoing question is much like that which (on one side at least), characterizes the articles on the several theories as to the nature of Lichens. A good illustration of this occurs in the same number of *Grevillea*, in a letter from Dr. Minks, the propounder of the new doctrine of the intra-hyphal origin of the gonidia of lichens. Dr. Minks attempts to set right Mr. Phillips' somewhat defective translation of the former's paper on Microgonidia in *Révue Mycologique*, and, it must be confessed, scarcely betters the matter. At some future time a summary of Dr. Minks' doctrine will be given in these pages.—— Charles B. Plowright, in *Grevillea*, describes the method of spore diffusion in a species of morel (*Morchella gigas*). Specimens gathered and laid upon boards in a room, were observed in the slanting rays of the setting sun to be surrounded by a cloud three or four inches deep on all sides. This proved to be due to the myriads of ascospores which were elastically escaping from the asci.—— In the December *Journal of Botany*, there appears an interesting account of George

Murray's experiments undertaken to determine the method of the diffusion of the conidia of the potato disease *(Peronospora infestans)*. Microscopic slides coated with glycerine were exposed on the lee side of an infested potato field, and carefully examined at intervals of from ten to twelve hours, *i. e.*, at 9 A. M. and 7 P. M. No conidia were caught during the night, but upon the twenty-eight square inches of surface exposed during the day, there were caught in the first day 15 conidia; in the second, 17; in the third, 27; in the fourth, 4; in the fifth, 9. Considering the small amount of surface exposed by the slides, and the fact that only about two per cent. of the potato plants in the field were diseased, the number of conidia caught is very large.—— Henry M. Douglas, of South Richland, N. Y., has undertaken to translate the successive numbers of the *Botanische Zeitung*, as they appear.—— Queen & Co., of Philadelphia, have prepared a series of twenty-four slides of microscopical specimens illustrating many points in the histology of the higher plants. They are neatly mounted and will be useful to many teachers and students.—— The *American Monthly Microscopical Journal* has, during the past year, contained many valuable botanical articles; among these may be mentioned several Notes on Fresh-water Algæ, Double-staining of Vegetable Tissues, The Salmon Disease and its Cause, besides many upon Diatoms. The microscope is now indispensable to the botanist, and it is encouraging to find that microscopical journals are beginning to make themselves useful to him also.—— *Science* has now a botanical department.—— W. P. Schimper's herbarium (of mosses) has been purchased by the Kew Herbarium.—— In Nos. 46—50. of *Botanische Zeitung*, Goebel publishes an interesting paper on the Morphology and Physiology of Leaves, accompanied by a plate with many figures.—— In No. 50 of the same journal Strasburger's paper on cells with several nuclei, and some points in the embryogeny of Lupinus, promises to be of considerable value. —— A new and thoroughly revised edition of Rabenhorst's Cryptogamic Flora of Germany, Austria and Switzerland is announced. Of the first volume (Fungi), the first part is now ready.

ZOÖLOGY.

Description of a Hermaphroditic Phyllopod Crustacean (Eubranchipus).—The single specimen of *Eubranchipus vernalis* here described was found in January, 1880, in a small, isolated pool, near Maspeth, L. I., living in company with a great number of a pale, transparent race of *Eubranchipus vernalis* Verrill. The hermaphrodite belonged to form A, as already pointed out in a paper read before the American Association for the Advancement of Science, in August, 1880.

Owing to my often taking it out for closer inspection, it died after having been kept in the aquariam for three days.

Genital Organs.—The female side consisted exteriorly of two

closed protuberances, a larger, less pointed one, opposite the cirrus, corresponding with the valvule, and a smaller one a little above the middle of the sac where the muscle m^2 is inserted. The internal female organs were but poorly represented, consisting of a somewhat triangular "oviduct," with its two elongate termini closed and suspended by three principal muscles. The latter

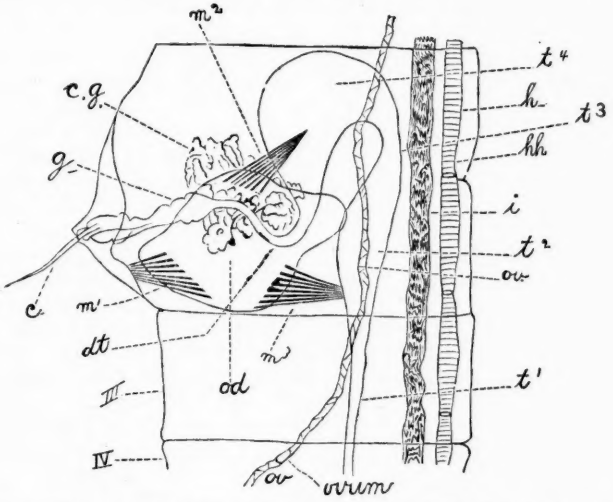

FIG. 1.—Hermaphroditic form of *Eubranchipus vernalis* V. The first three post-abdominal segments. *h*, heart; *hh*, ostium of heart; *i*, intestine; t^1, testicle; t^2, 1st dilated part of test.; t^3, contr. part or vas. def.; t^4, 2d dilat. part or sem. ves.; *dt*, duct ejac.; *g*, glandular and access. app.; *c*, cirrus; III, 3d post-abd. segt.; IV, 4th post-abd. segt.; *ov*, ovarial twisted string; *od*, oviduct, *ovum*-egg; *c.g.*, cement-glands; m^1 m^2 m^3, muscles of the oviduct.

anastomosed with the generally intricate mass of muscles. (The latter is omitted in Fig. 1.) Muscle m^1, of Fig. 1, was inserted near the larger, outer protuberance broadly spreading over the anterior terminus of the oviduct, the muscle *(m^3)* below the posterior terminus of the oviduct, and muscle *(m^2)* was inserted in the second smaller, outer protuberance.

This outer protuberance was constantly contracting and expanding itself, the area of the motion was exteriorly confined to this small protuberance only. The rhythmic contraction of the three principal fascicles revolved the "oviduct" to about one-fifth of its shorter diameter, in a semi-lateral direction.

There was no dissepiment between the male and female sac, and the interior uterine second sac was entirely absent in the female half.

The ovarial string passed up from the post-abdomen behind the

detached "oviduct" and thence up to near the last left branchiped. The portion of the ovarial string passing through the genital segments was slightly moved backward and forwards, apparently by some hyaline fibers of the intricate mass of muscles connected with the "oviduct."

A single elongate white ovum *(ovum)* could be observed in the ovarial string in the fourth post-abdominal segment, near the third, during the entire time of observation.

The cement-glands were irregularly distributed in clusters around the posterior and middle part of the oviduct, the larger of them being between the latter and the male organs. The glands were all of a dark-brown color, which did not change during the time of observation, and were slowly moved to and fro by the network of muscles. The exterior of the female side was comparatively not as largely expanded as usual in normal individuals.

The internal male organs were of their normal course, shape and position; the exterior of the same presented, owing to the pointed lateral protuberance, the peculiar figure indicated by drawing Fig. 2, dorsal view. The male side was voluminously swollen out anteriorly.

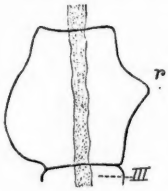

FIG. 2.—Dorsal view of genital sac (exterior) of hermaphroditic Eubranchipus. *r*, right side; *III*, third post-abdominal segment.

The female clasper (Fig. 3 *a*) was normal and of the form of those of the red Eubranchipus.; the male clasper (Fig. 3 *b*) also presented the form of those of the normal red form, and was in its entire length very finely corrugated; the tips of both, the longer and shorter branch of the clasper were less corrugated than in the normal individuals. The tentacles on right side only and normal. Cirrus normal, neither dentate nor perforate.

Note.—I suspect the lateral protuberance on either side of the genital segment to be the exterior rudiments of a second evagination, corresponding with cirrus or valvule, the antimeres or duplicates of each exterior member, the female sac being in this case but a closed large protuberance.

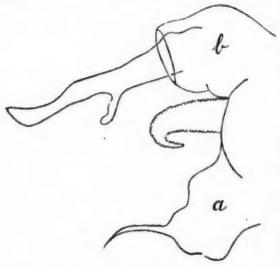

FIG. 3.—Head of hermaphroditic Eubranchipus.

This imperfect hermaphrodite may be compared with a male and female individual of Eubranchipus grown together side by side, the limbs, etc., in general consolidated, the male and female outer claspers, cirrus and valvule, being preserved (the latter also partly degenerated) along the median connate line, leaving the antimeres of the latter two external organs rudimentary in the shape of a protuberance or little knob on the lateral line.

The order in which the organs of reproduction and their auxiliaries make their appearance in Branchiopodidæ, is as follows: 1. Genital glands; 2. External genitals (Spangenberg's paper, p. 42), and 3. Auxiliary organs (claspers).—*C. F. Gissler, Ph.D.*

Habits of the English Sparrows in the United States.—The severe handling which that little immigrant, the English sparrow *(Passer domesticus)*, has of late received on all sides in the United States, and especially from our men of science, has sometimes made me feel disposed to consider the little fellow over abused, and has tempted me to say a word in his favor. But as even his enemies acknowledge he is more to be feared than despised, and as he has also not been without his advocates, I have hitherto refrained from interfering, and have remained a silent looker on.

One day in the early part of the month of January, 1880, during a high wind, a bird house occupied by birds of this species, and attached to a tree growing in the grounds connected with one of our public institutions, was brought to the ground by the giving way of a decayed branch. I was surprised to find it completely filled with a mass of rubbish consisting of dried grass, straw, weeds of various sorts (principally Amarantus and Chenopodium), horse hair, thread, rags, paper and feathers. The entire arrangement forbid the supposition that it was intended for nesting purposes, and an examination of the other sparrow-houses in the extensive grounds established the fact that they were similarly furnished. It was clearly a provision on the part of the bird against the cold of our severe winters. The gardener, who looked at it in the same light, informed me that he had to clean out this rubbish from the houses every spring at nesting time, and that it was not their nests, which are altogether different. This is exceedingly interesting as pointing to the capacity for self-improvement in the species. I have failed to find any description of such a habit in the English sparrow, and it would seem to have been acquired since its advent to our shores; though it would be important to know whether it adopts this precaution against the cold in the more northern countries of Europe.

A short time before the above-mentioned occurrence, one of those birds, in the same grounds, was noticed as being sick. Several of the other sparrows waited most assiduously upon it with affectionate care, and kept it supplied with food which they continually brought it. During the night a "cold snap" set in, and the next morning the sick bird was seen, perched on a railing, its companions hovering over it with evident anxiety, and bringing it food which they tried to make it eat. On going up to the bird, it was found to be dead and frozen stiff. This incident exhibits the species in a very different light from that in which it is usually represented by its American biographers.

But now comes the other side of the picture. In the following

April, at the blossoming of the peach, which this year was unusually early, I saw, one morning, two English sparrows busily at work on a peach-tree in my yard, and, on going nearer, perceived they were nipping off the blossoms with terrible rapidity. The ground was already strewn with scores of the crimson flowers, and I have no doubt that, unless interrupted, the tree, which is of a fair size, would have been utterly stripped—to the last bud, within less than half an hour. Close watching failed to discover the object of the birds, whether they were in search of insect or vegetable food, or whether their action was an exhibition of mere wantonness or destructiveness, which latter conclusion it would be difficult to receive. On the following morning another of the species was found similarly employed on a neighboring peach-tree, which was being just as rapidly denuded of its blossoms. The flowers were nipped off by the bird's beak, at the peduncle, a short distance below the receptacle, as neatly and swiftly as though done with a pair of scissors. This opened to my gaze such a horrible vista as to the destructiveness of the bird, that I turned away aghast at the spectacle. At this rate a few pairs of this sparrow would destroy the crop of an entire peach orchard in the course of two or three days. It cannot be, however, that this is a general habit of the bird, as our peach crop this season was the most abundant which we have had for years; fine peaches being retailed here, early in the season, at as low as three cents per quart.

Considering the destruction wrought by insect pests in our Southern States, I have thought this sparrow would prove of great benefit to that region, saving millions of dollars in the cotton, corn, vegetable and tobacco crops. The climate would also seem to be more suitable for it, particularly during the winter.—*Henry Gillman, Detroit, Michigan.*

Intelligence in a Cat.—The chief of our pets is "Shorty," a castrated cat now fourteen years old. Of course he has led a very quiet, dignified life, always at home, and never addicted to roof music at nights. He is a dear old fellow—neat and tidy in his habits, and taking the presence of any kind of filth as a matter of deep disgust and offence. In his middle age—avoirdupois sixteen pounds—he was a "mighty hunter." His greatest recorded feat being the killing of nine rats in one pleasant afternoon. It is an abomination in his ears to have them pierced by the "discordant noises" of a cat fight. One day, years ago, two younger felines engaged in an animated discussion with claws and teeth, filling the air with yells and flying fur. "Shorty" heard it, and ran in a succession of flying leaps to the spot. He bounded in between the two "bad boys," separating them in an instant. There he stood for a brief space, eyeing first one and then the other, with his right paw elevated, and growling fiercely. The youngsters drew down their arched backs, the

bristling tails collapsed, and they left the spot, each in a different direction, at the command of the peace maker. He once "brought up" a motherless kitten. At first, he was highly indignant at the presence of the little one, but finally took charge of it most kindly and tenderly, allowing it to suck his rudimentary teats. He afterwards weaned it, and then hunted for it, precisely as a "mother kitty" would have done! "Shorty" seems always *sensible* of the fact, if any of the family are ill or feeling blue or discouraged; in such cases he springs into one's lap and purrs his loudest, *looking* his sympathy most unmistakably, as much as to say, "Don't feel badly—don't be discouraged!" On one occasion a lady of the family while suffering from a severe attack of toothache, burst into tears. "Shorty," who was regarding her intently, sprung upon her lap, and placing a paw on each side of her neck, looked into her face, giving utterance to frequent and piteous mews. That his friend was suffering grievously, he *knew* as well as anybody, and he manifested his sympathy and regret in quite as decided a manner. Many anecdotes of the old fellow are treasured up in the legends of the family, but the above are probably as characteristic as any. He is now in "the sere and yellow leaf," being afflicted with "rheumatics" when the weather is heavy, and having lost his under tushes, but we cherish him for the good he has done, and for the kindly sympathy he has always manifested for his friends.—*Chas. Aldrich, Webster city, Iowa*, 1880.

Curious Habit of a Dragon-Fly.—One day this summer when I was looking at some tadpoles in a dish of water, I was struck in the face by a jet of water. On searching for the cause, I found that the larva of a dragon-fly (Æschna) was my assailant. When disturbed it sent out a fine stream of water from the branchial apparatus in the caudal end of its body to the distance of two or three feet, and not content with one volley, it would wheel and discharge, like a small gun, at all points of the compass. I put it in a tumbler of water, and it lowered the front of the body, and shot the water far over the edge of the glass. I cannot say it ever took deliberate aim, but I know I got sprinkled many times when I inadvertently touched the glass.

Prof. Packard, in writing of the larval dragon-fly, says, "By a syringe like apparatus lodged in the end of the body, it discharges a stream of water for a distance of two or three inches behind it, thus propelling the insect forward. The apparatus combines the functions of locomotion and respiration." (Guide to the Study of Insects, p. 601.)

If all Æschnæ have the same habits as the one I caught, we must add that the apparatus is also a means of defence.—*Sarah P. Monks.*

Migrations of the Sand-Hill Crane.—I had to-day a fine opportunity to watch the migrations of the sand-hill crane, and observe their method of managing their flight under adverse cir-

cumstances, that is with a strong wind in the rear. They were flying at great height, and during two hours several hundred passed over, going towards the south-west, the wind at the time being nearly due north and blowing quite hard. They would proceed in the ordinary manner for a short time, and then when the wind apparently became too strong for them, would wheel round and face it, and allow themselves to be carried along by it in the same way that a fish sometimes lets himself be carried down a rapid current, tail foremost, by simply putting forth just strength enough to keep his head up stream. When the wind slackened they would again wheel and pursue their way to repeat the same manœuvre a little further on. This might seem to be a very slow mode of traveling, but after watching a number of flocks I concluded that their rate of translation could not be much less than that of an ordinary railway train.—*F. E. L. Bent.*

Zoölogical Notes.—The last report for 1878 of Prof. Baird, as Fish Commissioner, contains an elaborate descriptive essay on the *Pycnogonida* of New England and adjacent waters, by Mr. E. B. Wilson. These spider-like forms, formerly placed with the Crustacea, are now generally acknowledged either to form an aberrant group of Arachnida, or a group intermediate between the Crustacea and Arachnida. This is, except an earlier paper by Mr. Wilson, the first systematic treatment of these animals in this country, and the report is supplemented by excellent figures with many details. —— It is by some supposed that the *Monera* of Haeckel is a premature group and should be merged with the genuine Rhizopods; however this may be, a new *(Monopodium kowalevskyi)* has been discovered at Naples by K. Mereschkowsky. It has no nucleus, the point of distinction between Monera and Rhizopoda.——As regards the importance of *Foraminifera* to the doctrine of descent, Professor Moebius, contrary to Carpenter's opinion that owing to their unusual tendency to variation they were not of much value to the evolution theory, believes that as confirmatory of Darwin's theory of descent, they possess a value neither greater nor less than that of all other classes of animals.——As the last contribution to the question as to the origin of the radial symmetry of the Cœlenterates, Prof. John Young has argued from the order of development of the septa and tentacles, that the radiate form of Cœlenterates arises from the shortening and crowding together of the successive septa either side of a line of bilateral symmetry, by which an apparent radiation around the mouth is produced. ——Among recent ornithological publications is Dr. Coues' Third Installment of American Ornithological Bibliography. It forms over five hundred pages of the Bulletin of the U. S. Geological Survey of the Territories, v, No. 4. This, with the two other parts, "represent a nearly complete bibliography of ornithology, so far as America is concerned." The annual report of Capt. G.

M. Wheeler, Corps of Engineers, for 1879, contains an ornithological report on observations and collections made in portions of California, Nevada and Oregon, by Assistant H. W. Henshaw. Mr. Henshaw is now in Oregon and Washington Territory, taking the census of the Indian reservations in that region, but will doubtless find opportunities for ornithological studies in that interesting section.——Under the heading "Infusoria as parasites," Mr. W. S. Kent, in the *Popular Science Review*, enumerates ten species of *Flagellata* and fifteen species of *Ciliata* which are genuine parasites in the viscera of birds, frogs, &c., ducks and geese, house-fly, the blood of Indian rats, a nematode worm, the common cockroach, a myriopod (Julus), a water beetle, earthworm, a marine planarian of several fresh water snails, besides Dr. Salisbury's *Asthmatos ciliaris*, which he regards as an active agent in the production of one form of hay asthma or hay fever.——In a recent paper in *Kosmos*, Fritz Müller describes a Brazilian fly *(Paltostoma torrentium)* with two forms of females.

ENTOMOLOGY.[1]

LARVAL HABITS OF BEE-FLIES (BOMBYLIIDÆ).—In the last number of the *American Entomologist*, we gave from advance sheets of the Second Report of the United States Entomological Commission an account of the larval habits of Systœchus and Triodites, showing that they prey on locust eggs, and drawing the following conclusions:

The discovery of the "parasitism" of these bee-flies upon locust-eggs at once suggests a comparison with the similar diversity of parasitic habits among the Meloidæ as given in our first report, some of them infesting bee-cells, while others, as the true blister-beetles (Lyttini), feed on locust eggs.

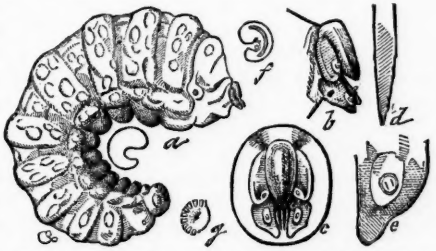

FIG. 1.—*Systœchus oreas; a*, larva; *b*, head, from side; *c*, do., from front, partly withdrawn into first joint; *d*, left mandible; *e*, left maxilla; *f*, prothoracic spiracle; *g*, anal spiracle (after Riley).

The Anthracids are now united by the best authorities with the Bombyliidæ, of which family as a whole Osten Sacken has said, they are "perhaps the most characteristic and one of the most abundantly represented families of Diptera in the western region, including California." The abundance of blister-beetles is also well known to characterize this region, and we have shown how this abundance is connected with the abundance of locusts. It is

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

of interest, therefore, to find that the bee-flies bear a similar relationship of parasitism to the latter, and that the characterization of the fauna in these two groups is really dependent upon the presence of the locusts as well as upon the rich representation of the burrowing Hymenoptera.

FIG. 2.—*Systœchus oreas;* pupa (after Riley).

Reviewing what had been published as to the larval habits of the true Bombyliids, we concluded that while there was strong presumptive evidence that they preyed on bee larvæ, there was yet no proof, and that the locust-egg-feeding habit we recorded, weakened the presumption. Since the publication of our article we have met with one previously overlooked, "On the Economy, etc., of Bombylius," by T. A. Chapman, M.D., in the *Entomologists' Monthly Magazine* for February, 1878 (Vol. XIV), p. 196. Mr. Chapman gives abundant proof of the parasitism of the European, *B. major*, on *Andrena labialis*. He records some observations on the oviposition of Bombylius, the small white egg being thrown with a short jerk against the earth near where the food of its future larva presumably occurred. This would also imply that, as in the case of the blister-beetles, the newly hatched larva must seek its food, and strengthens our suspicion that it will be found to be much more active than the mature larva. Mr. Chapman very fully describes the mature larva and the pupa, and his descriptions show that in all essential points the larva of Bombylius accords with those of Triodites and Systœchus. We quote his description of the head: "The head is set into this segment [the 1st thoracic] and is retractile; it is very small; its center is occupied by a prominent wedge-shaped portion, the point of the wedge being downwards, and immediately in front of the mouth. Immediately beneath this are two black, very sharp, setiform jaws (?); on each side is a papillary eminence (antenna?) of three joints set in a circle of softer tegument, and immediately below project downward on each side two large palpi (labrum?) looking like jaws, but having a vertical, not a lateral mobility, on the anterior face of each of these there is a palpus of some length, apparently unjointed, set in a circle." It will thus be seen that he homologizes the parts

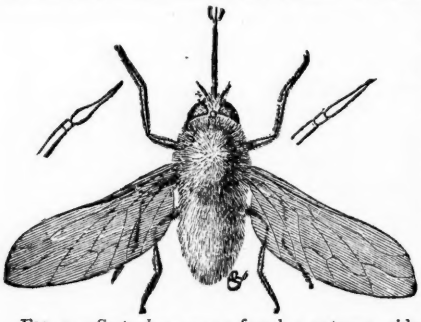

FIG. 3.—*Systœchus oreas;* female; antenna, side view, to left; do. top view, to right.

much as we have done, except that he refers the two lower palpigerous pieces, with a question, to the labrum (misprint for labium?) which they cannot possibly be; they are evidently the maxillæ. The upper lateral pieces bearing the antennæ are much less conspicuous, judging from the description, in Bombylius than in Systœchus. The pupa of Bombylius, from Dr. Chapman's excellent description, differs in the greater prominence and somewhat different arrangement of the cephalic spines, the anterior pair being stouter and more bent forward than in either of the genera we have treated of. Dr. Chapman speaks of these spines forcibly reminding him of the tusks of a walrus and of their admirable adaptation to tearing down the clay stopping and digging through as "with mattock and shovel" the long burrows of the bee upon which it preys. The dorsal and anal spines are also much more prominent than in our locust-egg parasites. The pupa of Systœchus and Triodites, not being under the necessity of such strenuous digging, have a less formidable armature; otherwise there is strict structural correspondence with Bombylius.—*C. V. Riley.*

Experiments with Pyrethrum: Safe Remedies for Cabbage Worms and Potato-Beetles.—The following experiments with Pyrethrum were made, at our request, by Prof. A. J. Cook, of the Michigan Agricultural College, at Lansing. They are interesting as confirming all that we have hitherto said in recommendation of this powder for the imported cabbage worm, no safe and satisfactory remedy for which had been discovered before we recommended this powder and showed that it could be economically used when simply mixed with water. Its value, used in this way, for the Colorado potato-beetle as a substitute for the more dangerous arsenical compounds will at once be appreciated.—*C. V. R.*

Sept. 27, 1880.—I placed ten cabbage caterpillars *(Pieris rapæ* Schrank), in each of two small wooden boxes which were covered with wire gauze. In one box I dusted the least possible amount of Pyrethrum mixed with flower in the proportion of one part of the Pyrethrum to twenty parts of the flour. I sprayed those in the other box with a liquid mixture, using one tablespoonful of Pyrethrum (7 grammes $\frac{1}{60}$ lb) to twenty gallons of water. In five minutes all the larvæ were on their backs. Nor did any of them recover. A large number of the caterpillars on the cabbage plants were sprinkled or dusted with the Pyrethrum, the proportion the same as given above. In one hour the plants were examined and in every case the caterpillars were found dead.

The same experiments as those detailed above were tried with the potato-beetle *(Doryphora 10-lineata).* Those in the boxes were all down in fifteen minutes, both beetles and larvæ; nor did they recover. I watched those on the vines for twenty minutes, when several had fallen to the ground. These were some distance

from my home, and I could not watch them longer. Whether all dropped or not I am not able to say, nor whether all or any recovered.

Wednesday, Sept. 29, 1880.—In the following experiments the cabbages were simply dusted or sprinkled with no effort to secure actual contact of the liquid or powder with the larvæ. The experiments were tried under my direction by a very trusty and careful assistant, Mr. Will. R. Hubbert, with the following results:

1st Experiment.—By use of a common sprinkler, nine cabbages were treated with the liquid mixture, composed of one tablespoonful of Pyrethrum (7 grammes) to a gallon of water. In one and one-half hours after the application, a *hasty* examination discovered thirteen dead larvæ and three live ones.

2d Experiment.—Ten cabbages were treated the same as above, except that two applications of the liquid were made; nineteen dead larvæ and one live one were found.

3d Experiment.—Twenty-six cabbages were treated with a liquid mixture of one tablespoonful of the powder to two gallons of water. One application was made with Whitman's Fountain Pump. Eleven dead and four live larvæ were found.

4th Experiment.—The same as experiment 3, on thirteen cabbages, except that two applications of the liquid were made. There were five dead caterpillars and two alive.

5th Experiment.—Twenty cabbages were dusted with a powder compound of one part of Pyrethrum to forty of flour; five dead larvæ and one live one were found.

6th Experiment.—Twenty cabbages were treated the same as No. 5, except that the mixture was in the proportion of 1 to 20; three dead and three live caterpillars were found.

The examinations in all the above cases were made one and one-half hours after the application of the liquid. The examination was too hasty to be thorough.

The next day all were again examined with great care, so that very few, if any larvæ were omitted in the count.

No. 1.	9	Cabbages,	17	dead,	39	stupefied,	3 alive.
" 2.	10	"	42	"	30	"	1 "
" 3.	26	"	18	"	0	"	58 "
" 4.	13	"	25	"	3	"	1 "
" 5.	20	"	18	"	3	"	9 "
" 6.	20	"	9	"	0	"	1 "

Friday, Oct. 1, 1880. *Experiment 1.*—Treated twelve cabbages: used one gallon water and ½ spoonful of Pyrethrum. Careful examination revealed eleven dead and eleven alive.

Experiment 2.—Twelve cabbages: used one gallon water to ¼ spoonful (2 grammes) of the powder. Eleven dead and four alive.

Experiment 3.—Twenty-six cabbages: used Pyrethrum and flour 1 to 40. Three dead, five alive and one stupefied.

Experiment 4.—Twelve cabbages: one gallon water to one spoonful of the powder. Result, thirteen dead, four alive and four stupefied.

The above experiments show conclusively that this powder is fatal to the caterpillars, and that too in very dilute liquid mixtures, as only $\frac{1}{200}$ of a lb. to the gallon of water was used in Exp. 2 of Oct. 1st, and eleven larvæ were killed. We have only to sprinkle it on to the plants, though it may be necessary to make more than one application to insure complete success. The success was better with the liquid than with the flour mixture, and can be applied with greater speed and economy.

A twig of alder *(Alnus serrulata)*, covered beneath with wooly Aphides *(Eriosoma tessellatum* Fitch), was dipped into the liquid mixture of $\frac{1}{60}$ lb. to a gallon of water. The next morning all the lice had fallen to the ground, never to rise again.

Flies and mosquitoes in a room where the powdered Pyrethrum had been blown in not very large quantities, less than $\frac{1}{100}$ of a lb. to a room twelve feet square, were felled to the floor, where nearly all remained till morning; though the application was made the night before. If not swept up some of the flies would recover. The flies commence to fall in ten minutes.

Squash bugs *(Coreus tristis)*, were kept in the clear powder, in a close tin box, for three days, and were still alive. I also sprinkled and dusted these insects on the vine, and could see no signs of success in killing them.

The Food of Fishes.—We have received an interesting contribution, with the above title, by Prof. S. A. Forbes, from Bulletin No. 3, Illinois State Laboratory of Natural History, November, 1880. The author gives the results of a large series of examinations of the stomachs of darters, perches, bass and sunfishes. He also separately considers the food of the young fishes as distinguished from that of the adult. His investigations have led to some interesting general conclusions, among which we commend the following as applying to studies in other departments of Natural History as well: "Nowhere can one see more clearly illustrated what may be called the *sensibility* of such an organic complex—expressed by the fact that whatever affects any species belonging to it, must speedily have its influence of some sort upon the whole assemblage. He will thus be made to see the impossibility of studying any form successfully out of relation to the other forms—the necessity for taking a comprehensive survey of the whole as a condition to a satisfactory understanding of any part. If one wishes to become acquainted with the black bass, for example, he will learn but little if he limits himself to that species. He must evidently study also the species upon which it depends for its existence, and the various conditions upon which *these* depend. He must likewise study the species with which it comes in competition, and the entire system of conditions affect-

ing their prosperity. Leaving out any of these, he is like one who undertakes to make out the construction of a watch, but overlooks one wheel; and by the time he has studied all these sufficiently, he will find that he has run through the whole complicated mechanism of the aquatic life of the locality, both animal and vegetable, of which his species forms but a single element. * * * * "I cannot too strongly emphasize the fact frequently illustrated, I venture to hope, by the papers of this series—that a comprehensive survey of our entire natural history is absolutely essential to a good *working knowledge* of those parts of it which chiefly attract popular attention—that is, its edible fishes, its injurious and beneficial insects, and its parasitic plants. Such a survey, however, should not stop with a study of the dead forms of nature, ending in mere lists and descriptions. To have an *applicable* value, it must treat the life of the region as an organic unit, must study it *in action*, and direct principal attention to the laws of its activity."

Prof. Forbes believes, from results so far obtained, that it will prove to be a rule "that a fish makes scarcely more than a *mechanical* selection from the articles of food accessible to it, taking almost indifferently whatever edible things the water contains which its habitual range and its peculiar alimentary apparatus enable it to appropriate, and eating of these in about the ratio of their relative abundance and the ease with which they can be appropriated at any time and place. If this is so, knowing the structure of a fish and the contents of a body of water, we shall be able to tell, *a priori*, what the fish will eat if placed therein."

Insect Enemies of the Rice Plant.—In the October number of the *American Entomologist* (Vol. III, p. 253), we published an interesting communication from Mr. John Screven, of Savannah, Ga., addressed to Dr. J. L. LeConte, regarding insects injurious to the rice plant. We then referred the Scarabæid larva (or "grub") which feeds upon the roots provisionally to the genus Ligyrus, being led to this conclusion by the circumstance that a species of this genus (*L. rugiceps* Lec.) attacks, in a similar way, the roots of sugar cane in the south, and that another species (*L. relictus* Say,) which is common farther north, has been observed feeding on the roots of wild rice in the marshes bordering Lake Erie. Meanwhile Mr. Screven kindly sent us specimens of the perfect insect, which proves to be a closely related form, *Chalepus trachypygus* Burm. This beetle occurs through the whole extent of the Southern States, and is very common along the edges of the swamps, in the pine barrens and in similar moist grassy places, feeding both in the larva and imago states on the roots of grasses.

Of the second species attacking the roots of rice, the "maggot" of Mr. Screven (see *Am. Ent.* III. p, 262–3), no perfect insects

have been received yet, but renewed examination of the larva seems to confirm our opinion previously expressed (l. c. p. 253), viz: that it is a Cerambycid allied to Oberea. If so, the species in question is possibly *Spalacopsis suffusa* Newm., which is by far less rare in the Southeast than is generally supposed. The perfect insect occurs in large numbers, in June and July, in very wet grassy places, its larva doubtless boring in the stems or roots of grasses which are more or less covered with water. The beetle, however, is very liable to be overlooked even by an experienced collector, as when approached it "plays possum" and is then almost undistinguishable from a piece of dry grass.

The "water weevil" mentioned by Mr. Screven as injurious to rice we conjecture to be a species of Centrinus (perhaps *C. concinnus* Lec.?) or of an allied genus of the Barini group, as several species thereof occur in great numbers in wet, grassy places in the South, and as the larvæ of this group are known to live in the roots or stems of plants.

In this connection we would finally call attention to the reported recent appearance of a formidable insect enemy to the rice plant in the East Indies. Mr. Wood Mason, deputy superintendent of the India Museum has identified it as belonging to the genus Cecidomyia, which genus "has never before been found in India," and proposes the name of *C. oryzæ*, for the species, which threatens to become very destructive to the rice crop.

Description of a New Species of Cynips.—*Cynips q. Rileyi*, n. sp.—The galls of this species have been accurately figured in the *American Entomologist*, Vol. III, p. 153, by Prof. Riley, who received them from North Bend, Ohio. In the only specimen I have, the twig on which the galls grow is three-sixteenths of an inch in diameter and the galls rise about one-fifth of an inch, but the specimen figured is apparently larger than mine. As Prof. Riley has remarked, the galls bear some resemblance to those of *C. q. punctata* B. The latter are, however, of a hard woody structure, while the former are of a cork-like consistence, and apparently quite destitute of woody fiber. As all the flies I have reared from these galls are females I think it will prove to be the one-gendered form of one of our many dimorphic species To this new and in many respects very interesting species I have given the name of my esteemed fellow-laborer in this interesting branch of entomology, and to whom I am indebted for the specimens described.

Galls. Abrupt, irregular swellings on the twigs of *Quercus castanea;* varying in size and form from round, pustule-like bodies, one-fourth of an inch in diameter, and containing a single larva to a confluent mass of galls an inch or more in length and half an inch in diameter and containing many larvæ. The larger ones sometimes nearly or quite encircle the twig. Externally they are covered with a smooth, healthy bark like the unaffected parts of the branch. Internally they are of a dense cork-like substance, which is inseparable from the enclosed larval cells.

Gall-fly. Head black, smooth and shining. Antennæ short, antennal joints

thirteen; 1st joint, short, thick, truncate, 2d, short, oval; in color both are of a dark amber; 3d joint equal to the two preceding taken together, color yellowish-brown; 4th to 13th inclusive, a dusky yellowish-brown. Face black; mandibles yellowish, with black tips. *Thorax* small. Mesothorax rises abruptly above the very narrow collare; it is smooth, shining, black and grooveless, but under a one-eighth magnifier presents a minutely crackled surface, with a few scattered white hairs. Scutellum smooth, rounded and separated from the anterior portion of the mesothorax by a broad, shallow and highly polished groove. Wings small, hyaline, veins dark brown, heavy; the subcostal uniform its entire length, areolet large, well defined; radial area long and narrow, open. *Legs* dark shining brown, with pale yellowish joints. *Abdomen* subpedicellate, smooth, black, polished; in dry specimens truncate by the insheathing of the last three segments within the others.

Length, .11. Length of wings, .11.

Described from 12 specimens, all females, in my collection.—*H. F. Bassett, Waterbury, Conn.*

THE "YELLOW FEVER FLY."—In the last number of *Psyche* (September, 1880), Dr. H. A. Hagen gives some references to a fly belonging to the genus *Sciara*, which has been dubbed the "Yellow Fever Fly," presumably, judging from the context of the article, because it has been observed to swarm more particularly during yellow fever epidemics. The larvæ of this genus of flies are well known to feed upon the humus in soils and other decaying vegetable matter, and it is more than probable that the conditions which favor the development of the yellow fever also favor the development of these flies. We certainly cannot conceive any other connection between the insect and the disease. Based upon a list of swarms of Diptera by Prof. Weyenburg in 1861, in which *Sciara* is not included, Dr. Hagen considers the appearance of this fly in swarms, as described by Dr. Ravenel in South Carolina, as new. We have frequently observed them in swarms sufficiently dense to appear, at a short distance, like smoke.

The following unpublished letter received by us, with specimens, from Mr. S. S. Rathvon, of Lancaster, Pa., nearly twelve years since (March 22, 1869), also refers to flies of this genus as recorded in the *American Entomologist* (1, p. 186):

"I enclose a quill containing some Dipterous insects, which I received a few days ago from a friend in Bethlehem, Pa. He says they came out of the cracks between the floor boards, in July, in one of the upper rooms of a new addition built to their seminary, in millions. He counted five thousand on a single window, partly flying and partly running up the panes of glass. What seemed remarkable to him was that not one was seen in any other part of the house. Whilst living the wings were iridescent, but after death they lose this color. Near the end of August, last year, I had a partition fence painted on my premises, when the whole surface became covered with millions of little flies, with iridescent wings, very similar to these, and perhaps the same species. I confess that I know nothing about their name or history, although I have often noticed them adhering to newly painted buildings during spring and summer. What are they?"

WAYS OF LIMENITIS BREDOWII.—Mrs. A. E. Bush sends from San Jose, Cal., the following account of the flight and habits of this beautiful butterfly:

They are warriors and seem to have a good deal of character. They alighted on the white or black oaks high above, and with the appearance of being on the alert, waited till a large yellow Papilio came in sight, when it was chased away, and Limenitis returned to his perch awaiting for the next fray. A smaller butterfly routed the Limenitis, however. They were shy of light colors. When I had on a light-colored dress I could not get near one, but with a brown dress they would alight on it, and about my feet. Throwing small pebbles, chips or rocks at them seemed to enrage them, and they would follow anything thrown at them back to the ground. A Grapta, on the contrary, was attracted by a white hat, and hovered around my head like a bee above the flowers, and would alight on the hat and on my hand.

HABITS OF XYLOTRECHUS CONVERGENS.—The larva of this Longicorn beetle infests what we call thorn apple or red haw; comes to maturity in one year, and the imago makes its appearance about the 15th of June. I have taken it as late as July 1st. It kills the tree in one year after the egg is laid in the crevices of the bark. As soon as hatched the larva enters the wood, and hardly travels six inches. I am the only one here who has taken it so far; I have taken twenty out of a piece of wood three feet long.—*M. J. Myers, Ft. Madison, Ia., in letter to Dr. J. L. LeConte.*

AN AQUATIC SPHINX LARVA.—In the same number of *Psyche* above referred to, is an interesting communication by Baron von Reitzenstein, of New Orleans, La., describing a sphinx larva belonging to the genus Philampelus, which he found feeding on the floating Nymphæa in the centre of a draining canal, the whole body, with exception of the thoracic segments, being submerged under water. The larvæ are described as swimming with great facility from one patch of plants to another.

ANTHROPOLOGY.[1]

EARLY MAN IN BRITAIN.—The latest utterance upon this subject is from the pen of the distinguished cave hunter, Prof. W. Boyd Dawkins, entitled, "Early Man in Britain, and his place in the Tertiary Period," published in London by Macmillan & Co. The subject is treated in the three-fold point of view of the geologist, the prehistoric archæologist, and the historian. Beginning with the earliest period during which man is alleged to have made his appearance, the author passes downward through time, or, what is equivalent, upward through the geological record to the prehistoric iron age. The Tertiary period is divided into six

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

parts (p. 9): I. Eocene (living orders and families present); II. Miocene (living genera); III. Pliocene (living species); IV. Plistocene (living species abundant, man appears); V. Prehistoric (man abundant, domestic animals, cultivated fruits); VI. Historic (historic records).

Britain in the Eocene is described geologically and geographically, and after examining carefully the fauna and the flora, Mr. Dawkins concludes that man has no place in such an assemblage of animals. Nevertheless, the lowest member of the Primates was represented in the upper Eocene of Europe, and throughout the whole of that period in America.

The Miocene is divided likewise into upper, middle and lower, and the distribution of land and water, plants and animals, as well as the changes of climate and sea level discussed in the light of recent research. Was man in Europe in the Miocene age? All the conditions necessary to the primeval garden of Eden were satisfied. The flints of Thenay and the notched rib of Pouance are allowed their due weight, and yet Prof. Dawkins decides upon the whole, that the data are insufficient to establish man's contemporaneity with the Dinothere and other members of the Miocene fauna.

The Pliocene age is next passed in review, with the same systematic treatment. Europe is no longer joined with America, and profound changes take place in the geology, climate, fauna and flora of the former. The author, however, rejects the skull of Olmo, the cut bones of Tuscany, and other evidences of Pliocene man. He says, "Of twenty-one fossil mammalia in the Pliocene of Tuscany, only the hippopotamus is now living on earth. It is improbable that man should have been present in such a fauna. They belong to one stage of evolution and man to another and later."

Prof. Dawkins finds his earliest man in the Plistocene. The chapters upon the fauna of this age and the two races: the Drift men and the Cave men, are, to our thinking, the best in the book. In opposition to Mr. Evans, the author holds that these two series are entirely distinct states of culture, of which the Cave men are the newer and the higher. We are without a clue to the ethnology of the River-drift man, but the many points of connection between the Cave men and the Eskimos can be explained only on the hypothesis that they belong to the same race.

Then follows the civilization of the Prehistoric period, covering all the events which took place between the Pleistocene age and the beginning of history. No break of continuity is allowed, but the Tertiary period is looked upon as extending down to the present day. The Prehistoric period is divided into three ages, the Neolithic, the Bronze, and the Iron age. In the former men were divided into tribal communities, engaged in agriculture, herding and fishing. Spinning, weaving, mining, boat-building,

traffic by land and by water had begun to flourish. The dead were entombed under such conditions as to give an insight into the religious convictions of the people. On page 293 is the pregnant sentence, that each palafitte hut was inhabited by one family, and the whole settlement was not a community with common store houses, like a Mexican pueblo. This Neolithic culture is derived from Asia, and, after summing up the evidence, Mr. Dawkins regards the people as of the Iberian stock. They were succeeded by the Celts, who were, *par-excellence*, the Bronze age race. The various questions which have sprung out of the remains, as the origin of bronze, tin mines, the duration, culture, and religion of the Bronze age are elaborately worked up in chapters X and XI. The following and closing chapters treat of the Iron age, and the overlap of history, under which last head the influences of Egyptian, Assyrian, Phœnician, Etruscan, and Greek civilization upon that of Western Europe are briefly discussed.

It is to be regretted that our limited space will not permit us to enter more elaborately into the merits of this work, nor to speak of its defects any further than to draw attention to oversights, and a lack of consistency here and there in the proof-reading of an otherwise very handsome volume. If Mr. Dawkins has not already thought of the matter, we would call attention to the similarity of the flames from the head of the Dol-ar-Marchnant (page 305) to the speaking girdles and other like signs for voice and emotion in the works of Stephens and Hable.

THE ANTHROPOLOGICAL SOCIETY OF PARIS.—The *Bulletins* of this world-renowned society from January to April of the past year, have reached us through the Smithsonian Institution. In addition to the lists of officers and members, proceedings and correspondence, the following papers are given in full or in abstracts:

Sur la signification de la croix dit svastika et d'autres emblèmes de même nature, by Girard de Rialle; Sur les Lapons, by M. Mantegazza; Sur les Migrations en Egypte, by Emilie Soldi; Sur les Boschimans et les Hottentots, by M. Féraud; Inventaire des Monuments Mégalithiques de France: Report of a sub-Committee, composed of MM. Henry Martin, Daubrée, G. De Mortillet, Paul Broca, Cartailhac, Chantre, Leguay, Pomel, Salmon, du Sommerard, de Berthélemy, Fabsan, Trutat, and Viollet le Duc. [This is a detailed enumeration by departments of all the dolmens, menhirs, aleignments, cromlechs, cup stones, and other archæological localities throughout France]; Crâne Australien Brachycephalique, by M. Cauvin; Méthode trigonometrique: le goniométre d'inclinaison et l'orthogone, by Dr. Paul Broca; Sur un questionnaire anthropométrique a remplir dans les ecoles du departement de Loir-et-Cher, by M. Jacques Bertillon; Le developpement du cerveau chez les enfants du premier age, by M. J. Parrot; Sur le goniométre flexible, by M. Paul

Broca; Sur la traduction des inscriptions cambodgiennes, by M. Harmand; Sur l'utilité de rédiger des instructions linguistiques, by M. Vinson; Sur un Manuscrit de M. Régis Gery, by M. G. de Mortillet; Sur les Esthoniens, by M. Arthur Chervin; Sur l'ethnologie de la Nouvelle Guinée, by M. Mantegazza; Sur la vision de la serie des nombres, by M. d'Abbadie; Sur le buste d'une jeune fille zoulon, by M. Paul Broca; Sur une anomalie regressive de la crosse de l'aorte chez une jeune fille zoulon, by M. Paul Broca; Le cerveau de l'assassin Prévost, by M. Paul Broca; Sur la monographie de la femme de la Cochinchine, by M. Mondière; Sur les resultats d'une mission en Australie, by M. Cauvin; Sur les comptes de l'exposition des Sciences anthropologiques, by M. Issaurat; De différent instruments d'anthropométrie, by M. Paul Topinard; De l'influence du mariage sur la tendance au suicide, by M. Jacques Bertillon; Sur la génération au point de vue chronologique, by M. Réné de Semallé: Sur le voyage de M. Panàgiotis Patagos en Asie Centrale, by M. Ch.-E. de Ujfalvy; Sur l'usure spontanée des dents au point de vue ethnique, by M. E. Magitot; Sur les Sépultures doubles de Thuizy (Marne), by M. Edouard Fourdrignier.

Fossil Men and their Modern Representatives.—Under the foregoing title, Principal J. W. Dawson has published, through Dawson Brothers, of Montreal, an "Attempt to illustrate the characters and condition of prehistoric men in Europe, by those of the American Races." In this volume we have really two books, upon entirely different subjects. What we may call book first is a parallel between the ancient town of Hochelaga, discovered by Cartier in 1534, and occupying the site of modern Montreal, and the ancient stone people of Europe. The author's opportunities for following up a line of investigation initiated by Sir John Lubbock have been exceptionally good and he has not failed to use them, supplementing the data of Hochelaga with facts collected among our present red Indians. In the course of the argument the author throws out some pregnant suggestions; as, for example, the impossibility of maintaining the definite nomenclature of archæology popular ten years ago; the similarity of the oldest populations of Europe, the river drift and the cave men, to American aborigines; the identity of Schoolcraft Allegans with the Mound-builders; the anteriority of polished stone to rude stone folk; the spoke-like burial in the mounds as an imitation of lying in a teepec with the feet to the fire; the communal characters of the Swiss palafittes; the totemic significance of the engravings on bone in the European caves, &c. The portions of the volume designated here as the second book, are an argument to prove that all the events indicated by the discoveries of archæologists, in river-drifts, in caves, and in lake deposits, occurred in a few thousands of years. Without trying to follow Dr. Dawson in his discussion, it is but fair to say that his profound

knowledge of palæontology has enabled him to present the brachy-chronic view of archæology more forcibly than Mr. Southall or any other recent writer who has made the attempt.

GESTURE SIGNS.—Col. Garrick Mallery has issued, for collaborators only, a limited number of a quarto pamphlet of 329 pages, entitled, "A Collection of Gesture Signs and Signals of the North American Indians, with some comparisons. Washington, Government Printing Office, 1880." The work will not be published permanently in its present shape; but the descriptions are presented for the verification of observations, verbal corrections, and to secure accurate classification and comparison. Every contributor is thus enabled to revise his own work, as the volume is divided and arranged according to a scheme of linguistic families and subordinate languages or tribes. The author has taken the liberty to use his own judgment as to the admission or rejection of authorities, drawing a hard and fast line against all loose generalizers and vague talkers about what they have not examined in person over and over again. The amount of patient, critical discernment necessary to render such a work really valuable can be appreciated only by a careful study of Colonel Mallery's prefatory remarks, pp. 1–7, in which the principles which have guided him are clearly set forth.

REPORT ON INDIAN AFFAIRS.—Strange as it may seem, scholars seldom consult the report of the Commissioner on Indian Affairs for information concerning the Indians. In preparing his colossal work on the Native Races of the Pacific States, Mr. H. H. Bancroft examined the entire series up to 1872, but found only here and there a scrap of intelligence. Very notable exceptions to this sweeping statement are to be found, such as the papers of Governor Stevens and the report of General Walker, in 1872. We find reason to qualify our statement, also, in the report of Commissioner Hayt, for 1879. On page 118, Agent B. M. Thomas gives a list of all the inhabited Pueblos in New Mexico and Arizona, with their population, and an altogether too short sketch of their government. It is to be hoped that those who have the best possible opportunities of studying our aborigines will make better use of their time in the future.

TRANSACTIONS AND PROCEEDINGS OF THE NEW ZEALAND INSTITUTE.—Vol. XII of this valuable series for 1879, issued May, 1880, is not devoid of interest to the anthropologist, as the accompanying list of papers will show:

Notes on Port Nicholson and the natives in 1839. By Major Charles Heaphy.

On the ignorance of the ancient New Zealander of the use of projectile weapons. By Coleman Phillips.

Contributions towards a better knowledge of the Maori race. By W. Colenso.

Notes on an ancient manufactory of stone implements at the mouth of the Otokai creek, Brighton, Otago. By Prof. Julius von Haast.

Notes on the color-sense of the Maori. By James W. Stack.

Remarks on Mr. Mackenzie Cameron's theory respecting the Kahui Tepua. By James W. Stack.

Pronouns and other barat fossil words compared with primeval and non-Aryan languages of Hindostan and borders. By J. Turnbull Thomson.

Maori connection. J. Turnbull Thomson.

ASIATIC CULTURE IN AMERICA.—In No. 6, Vol. IX of the *Canadian Naturalist*, Prof. John Campbell, of Montreal, attempts to connect the Basques of Europe, the Nubians of Africa, the Circassians, on the border of Europe and Asia, the Koriens, the Japanese and other peninsular people of Asia, the Aleutians, Kadiagmuts, Dakotas, Iroquois, Cherokee-Choctaws, Muyscas, Peruvians, and Chilenos of America. The author sets out from the labors of Hyde Clarke, "to whom," it is said, "belongs the most of the discovery which bids fair to revolutionize the science of ethnology." The paper certainly exhibits a vast amount of patient research; but, after all, we fail to see in many of the words enough of resemblance to prove identity.

A NEW PERIODICAL.—On the 3d of July, 1880, the first number of a periodical with the title of *Science* was issued in New York, under the editoral charge of Mr. John Michels. Several valuable anthropological papers have appeared in its columns: Fragmentary notes on the Eskimo of Cumberland sound, by Ludwig Kumlien; Reports of Ethnological papers at the American Association, and notes scattered here and there on a variety of subjects. On page 205 is given Major Powell's vice-presidential address on the Wyandotte government before the American Association.

SKIN FURROWS OF THE HAND.—New anatomical characters are being brought constantly within the anthropological area. Only a few months ago the relative length of the ring-finger and the fore-finger was added to the list of marks for observers. Mr. Henry Faulds of Tsukipi Hospital, Tokio, Japan, has commenced in *Nature*, of October 28th, a series of papers on the ethnological value of careful observations relating to the finger marks on ancient pottery, to those of criminals, and of the anthropoid apes.

ETHNOGRAPHY OF THE CAUCASUS.—One of the neatest pieces of ethnographic work which it has been our good fortune to inspect is a paper in No. IX of *Petermann's Mittheilungen*, on the abovementioned subject, prepared by N. v. Seidlitz. The article is made up chiefly of tables of statistics upon the almost hopelessly mixed Indo-European, Caucasic and Mongolian peoples of this region. A colored map exhibiting the tribal distribution will be found at the end of the number.

POPULATION OF THE EARTH.—The sixty-second Supplement of *Petermann's Mittheilungen* contains Behm and Wagner's "Die Bevölkerung der Erde, VI." Although the greater part of this pamphlet of X—132 pages belongs to the statisticians, the ethnologist will find enough material for comparative study to make it worth his while to give it his attention.

GERMAN ANTHROPOLOGY.—The stenographic report of the eleventh annual meeting of the German Society of Anthropology, Ethnology and Prehistory in Berlin, August 5 to 11, is a quarto pamphlet of 160 pages. Unfortunately, there is no index, excepting a catalogue of names unaccompanied with the titles of papers.

CORRECTIONS.—Our regret at making mistakes is only equaled by our happiness in making amends. In the list of papers read before the Washington Anthropological Society (page 813) please insert "The old Roman Senate: a study in the comparative history of assemblies," by J. Howard Gore. The notes on Japanese mythology (page 902) were sent by some unknown friend, and not by Professor E. S. Morse. In speaking of Dr. Yarrow's "Mortuary Customs" (page 904), credit was not given him for distinguishing between inhumation within the cabin, wigwam or house, and simple abandonment of a lodge containing a dead body. The closing chapter on mourning, feasts, food, dances, songs, games, etc., connected with burial, was omitted from the reference to the contents of the volume.

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GEOLOGY AND PALÆONTOLOGY.

GEOLOGY OF SOUTHEASTERN PENNSYLVANIA.—In a previous number of this magazine, we have noted the salient points of Prof. Frazer's report on the geology of York county, Pa. We have now before us his complete report on that of Lancaster county, and understand that that relating to Chester county is in course of preparation. The maps of York and Lancaster counties accompany the volumes, and that of Chester has already been prepared. Extensive additions to and corrections of the existing map by Rogers have been made by Prof. Frazer, although the map of the First Geological Survey remains intact in its principal features, and maintains itself as the best one of its time published in the country. A comparison of this map with the new one by Prof. Frazer shows the following new points in the latter:

(1.) The definition of the Eozoic, Chlorite Schist, and Roofing Slate areas, which were confounded or omitted in the old map. (2.) The connection between the Chester and Pequea Valley areas of the Lancaster Limestone, previously represented as distinct. (3.) The discrimination of several tracts of the Eozoic within the territory of the Chickis quartzite. (4.) The discovery of a trap dyke twenty miles in length, traversing the Eozoic and Siluro-Cambrian beds from N. E. to S. W. (5.) The correct determinations of the trap dykes of the Jura-Trias region.

The report on mining industries and resources is very full, occupying nearly half the volume. The report on the Gap nickel mine of Bart township will attract attention. This industry, built up by the energy and perseverance of Joseph Wharton, of Philadelphia, has assumed large proportions, the production of nickel being in excess of the consumption in the United States, leaving

a surplus for export. Prof. Frazer shows that the metal is found chiefly as Millerite, encrusting masses of hornblende, which lie in the Eozoic gneiss.

A number of excellent engravings illustrate Prof. Frazer's report. Of the accompanying sections that exposed on the east bank of the Susquehanna river is the most extensive and instructive. As published, it represents an extensive anticlinal near the mouth of Tocquan creek, which is an important key to the relations of the rocks to the north and south of it. We would have been glad to have seen on this chart several other explanations of rock structure which appeared on the section as originally prepared by Prof. Frazer, but which were unfortunately omitted in publication. Many of the observed dips have also been erased, and figures pointing into the air substituted by the direction of the survey. The merits of this change are not obvious, since it renders incomprehensible what was previously clear to the eye.

ALLEGED CHANGES IN THE RELATIVE ELEVATION OF LAND AND SEA.—The view that the north-eastern coast of North America is slowly rising, and Professor Shaler's estimate of the rate as being probably over a foot a century, and perhaps as much as three feet, has been negatived by Mr. Henry Mitchell, according to the *American Journal of Science and Arts*, who states in the Coast Survey Report for 1877, that the rocks upon our coast, long notorious as dangerous to navigation, have not risen since they were first discovered, while the salt marshes are still as in the time of the early explorers at ordinary high-water level, He claims that no tilt in either direction has taken place in the Gulf of Maine. But east of long. 64° 13′, "and especially in Newfoundland, great changes present themselves in the comparison of charts, the depths appearing to be at some points less and at other points greater now than formerly."

CATALOGUE OF VERTEBRATA OF THE PERMIAN FORMATION OF THE UNITED STATES.

PISCES.

CROSSOPTERYGIA.

ECTOSTEORHACHIS Cope; Pal. Bull., No. 32, 1880, p. 19.
1. *E. nitidus* Cope; l. c. Texas.

DIPNOI.

CTENODUS Agass.
2. *C. fossatus* Cope; Proc. Amer. Phil. Soc. 1877, p, 54. Eastern Illinois.
3. *C. gurleianus* Cope; l. c., p. 55. Eastern Illinois.
4. *C. periprion* Cope; Proc. Amer. Phil. Soc. 1878, p. 527. Texas.
5. *C. porrectus* Cope; l. c. Texas.
6. *C. dialophus* Cope; l. c. p. 528. Texas.
7. *C. pusillus* Cope; Proc. Amer. Phil. Soc., 1877, p. 191. Eastern Illinois.

PTYONODUS Cope; Proceed. Amer. Philos. Soc. 1877, p. 192.
8. *P. vinslovii* Cope; Proc. Acad. Philada. 1876, p. 410. Eastern Illinois.
9. *P. paucicristatus* Cope; Proc. Amer. Phil. Soc. 1877, p. 54. Eastern Illinois.

SELACHII.

JANASSA Münst.
10. *J. gurleiana* Cope; Proc. Amer. Phil. Soc. 1877, p. 191. Eastern Illinois.
11. *J. strigilina* Cope; *S. linguæformis* Cope; l. c. p. 53, not of older authors. Eastern Illinois.
12. *J. ordiana* Cope; Texas.
DIPLODUS Agass.
13. *D. ? compressus* Newb. Eastern Illinois.
14. *D. sp.* Texas.
ORTHACANTHUS Agass.
15. *O. gracilis* Newberry. Eastern Illinois.
16. *O. quadriseriatus* Cope; l. c. p. 192. Eastern Illinois.

BATRACHIA.

STEGOCEPHALI.

GANOCEPHALA Owen, Cope (emend.) Amer. Natur. 1880, p. 60.

ERYOPS Cope; Proc. Amer. Phil. Soc. 1877, p. 188.
17. *E. megacephalus* Cope; l. c. Texas.
TRIMERORHACHIS Cope; Proc. Amer. Phil. Soc. 1878, p. 524.
18. *T. insignis* Cope; l. c. Texas.
ZATRACHYS Cope; l. c. p. 523.
19. *Z. serratus* Cope; l. c. Texas.
PARIOXYS Cope; l. c. p. 521.
20. *P. ferricolus* Cope; l. c. Texas.
PANTYLUS Cope; Bull. U. S. Geol. Surv. Terr. 1881 (80).
21. *P. cordatus* Cope; l. c. Texas.
EMBOLOMERA Cope, American Naturalist, 1880, p. 510.
CRICOTUS Cope; Proceed. Acad. Phila. 1876, p. 405.
22. *C. gibsoni* Cope; Proc. Amer. Phil. Soc. 1877, p. 185. Eastern Illinois.
23. *C. heteroclitus* Cope; Proc. Acad. Philada. 1876, p. 405. Eastern Illinois; Texas.

REPTILIA.

THEROMORPHA Cope; American Naturalist, 1878, p. 829.

PELYCOSAURIA Cope; l. c.

Diplocaulidæ.

DIPLOCAULUS Cope; Proc. Amer. Phil. Soc. 1877, p. 187.
24. *D. salamandroides* Cope; l. c. Eastern Illinois.

Clepsydropidæ.

PARIOTICHUS Cope; Proc. Amer. Phil. Soc. 1878, p. 508.
25. *P. brachyops* Cope; l. c. Texas.
ECTOCYNODON Cope; l. c.
26. *E. ordinatus* Cope; l. c. Texas.
ARCHÆOBELUS Cope; Proc. Amer. Phil. Soc. 1877, p. 192.
27. *A. vellicatus* Cope; l. c. Eastern Illinois.
CLEPSYDROPS Cope; Proc. Acad. Philada. 1876, p. 404.
28. *C. collettii* Cope; l. c. p. 407. Eastern Illinois.
29. *C. vinslovii* Cope; Proc. Amer. Phil. Soc. 1877, p. 62. Eastern Illinois.
30. *C. pedunculatus* Cope; l. c. p. 63. Eastern Illinois.
31. *C. natalis* Cope; Proc. Amer. Phil. Soc. 1878, p. 509. Texas.
DIMETRODON Cope; Proc. Amer. Phil. Soc. 1878, p. 512.
32. *D. incisivus* Cope; l. c. Texas.
33. *D. rectiformis* Cope; l. c. p. 514. Texas.
34. *D. biraaticatus* Cope; Bull. U. S. Geol. Surv. Terrs. 1880 (81).
35. *D. gigas* Cope; l. c. p. 515. Texas.
36. *D. cruciger* Cope; Amer. Natur. 1878, p. 830. Texas.
THEROPLEURA Cope; Proc. Amer. Phil. Soc. 1878, p. 519.
37. *T. retroversa* Cope; l. c. Texas.
38. *T. uniformis* Cope; l. c. Texas.

39. *T. triangulata* Cope; l. c. p. 520. Texas.
40. *T. obtusidens* Cope; Pal. Bull. No. 32, 1880, p. 4. Texas.

METARMOSAURUS Cope; Proc. Amer. Phil. Soc. 1878, p. 516.
41. *M. fossatus* Cope; l. c. Texas.

EMBOLOPHORUS Cope; l. c. p. 518.
42. *E. fritillus* Cope; l. c. Texas.

LYSOROPHUS Cope; Proc. Amer. Phil. Soc. 1877, p. 187.
43. *L. tricarinatus* Cope; l. c. Eastern Illinois.

Bolosauridæ.

BOLOSAURUS Cope; Proc. Amer. Phil. Soc. 1878, p. 506.
44. *B. striatus* Cope; l. c. Texas.

Diadectidæ Cope; Pal. Bull. No. 32, 1880, p. 8.

DIADECTES Cope; Proc. Amer. Phil. Soc. 1878, p. 505.
45. *D. sideropelicus* Cope; l. c. Texas.
46. *D. phaseolinus* Cope; Pal. Bull. No. 32, 1880, p. 9. Texas.

EMPEDOCLES Cope; Proc. Amer. Phil. Soc. 1878, p. 516.
47. *E. alatus* Cope; l. c. Texas.
48. *E. latibuccatus* Cope; l. c. Texas.
49. *E. molaris* Cope; Pal. Bull. No. 32, 1880, p. 10. Texas.

HELODECTES Cope; Pal. Bull. 11, No. 32, p. 11.
50. *H. paridens* Cope; l. c. Texas.
51. *H. isaaci* Cope; l. c. p. 12. Texas.

SYNOPSIS.

PISCES			15
Crossopterygia		1	
Dipnoi		8	
Selachii		7	
BATRACHIA			7
Stegocephali		7	
Ganocephala	5		
Embolomera	2		
REPTILIA			28
Theromorpha		28	
Pelycosauria	28		
			—
Total number of species			51

—*E. D. Cope.*

GEOLOGICAL NEWS.—Professor Gaudry has recently obtained from the Permian of Igornay in Central France, the bones of a Theromorphous reptile of considerable size. He regards it as an ally of the carnivorous forms which have been discovered in Texas, Russia, etc., and names it *Stereorhachis dominans.*—— Professor Cope describes in the current number of Hayden's *Bulletin* a new carnivorous saurian from the Permian of Texas, in which the roots of some of the teeth are so deeply grooved as to be almost double. He names it *Dimetrodon biradicatus.*—— The deposit of chloride and bromide of silver at Leadville, Colorado, proves to be more extensive east of the city than has been supposed. Strikes of great richness have been made in the Denver City, near the R. E. Lee; the Scooper, the Leavenworth and the Sovereign, the latter nearly a mile east of the Lee.—— M. Daniel de Cortazar of the Geological Survey of Spain, has examined the geology of the Province of Toledo, and has published a geological map. The river Tagus, which traverses the province

from east to west, flows through a wide band of diluvium, which is bordered on each side by other formations. These are, to the east, miocene and eocene; west of this, granite and gneiss. To the south there are extensive areas of silurian and cretaceous. The map is a handsome piece of engraving, but is on a small scale.

GEOGRAPHY AND TRAVELS.[1]

THE EAST CENTRAL AFRICAN EXPEDITION OF THE ROYAL GEOGRAPHICAL SOCIETY.—At the meeting of the Royal Geographical Society, held November 8, 1880, Mr. Joseph Thomson, the leader of this expedition, read an account of his explorations including many previous details not previously known.

The lofty plateau extending round the northern and eastern sides of Lake Nyassa and reaching half way to Tanganyika rises from 6000 to 9000 feet, and is so cut up by denudation as to appear like a series of mountains. "It consists to the north and west of metamorphic clay slates, with here and there felspathic rocks intruding, while immediately round Nyassa the rocks are purely volcanic porphyrites and tuffs. The difference in the external surface of this plateau has determined to a very marked extent the surface outlines produced by denudation. Thus the mountains of clay slate are distinguished by rounded grassy forms, generally smooth and uncut, uniform in shape and color, and by no means picturesque. Pass from these to the volcanic rocks, and we observe at once a marked change. We have sharp jagged peaks, precipitous rocky sides, notched and cut in the most irregular and striking fashion, as becomes mountains formed of such diverse materials as compact lava beds and loose tuffs and agglomerates. Add to these features huge yawning gorges and great precipices where vegetation in vain attempts to grow, and some notion of this plateau may be formed."

On this high tract of land were found most miserable and degraded types of the Negro race. "These people have dark, sooty skins, prognathous jaws and thick lips, with small heads and shrunk-up withered bodies which speak of an existence of the most miserable character. They go, as a rule, perfectly naked, and live in conical huts seven feet high and five or six feet in diameter, crawling in and out through a hole." "It was found almost impossible to communicate with them, as they seemed to be entirely devoid of any abstract ideas, and appeared to be completely shut off from all knowledge and communication with the outside world." "Mr. Thomson," remarks the *Academy*, "seems to have formed the idea that these tribes are in their present condition from having remained absolutely isolated; but others may incline to the opinion that it is a case of gradual degeneration."

The commercial importance of this portion of Central Africa is

[1] Edited by ELLIS H. YARNALL, Philadelphia.

not great. "Nowhere," says Thomson, "have I seen a single metal in a form which a white man would for a moment look at as a profitable or workable speculation. There is, no doubt, a considerable abundance of iron in many parts, but very little more than sufficient to supply the simple wants of the natives. Coal I saw none, and my researches would lead me to believe that such a thing does not exist over the wide area embraced by our route." "The chief characteristic of this part of the country was its utter barrenness and the absence of anything worth trading for."

The expedition marched for six days along the Lukuga, the outlet of Lake Tanganyika and which pursued its tumultuous course in a W. N. W. direction "through one of the most charming valleys I have ever seen in Africa; beautifully wooded hills rising on each side from 600 to 2000 feet above the level of the lake, while forest clumps and open glades diversified the scenery along the river's banks, where antelopes and buffaloes grazed in abundance." The refusal of his men to go further prevented Mr. Thomson's following the river to its junction with the Congo.

While there is much beauty and picturesqueness in the scenery along the shores of Tanganyika one is on the whole, disappointed in its monotony. There was the same unvarying tint of green, the same unbroken hill-ranges which would have been inexpressibly dreary but for the frequent appearance of a jutting cape or small island. The chief feature in the scenery was the immense boulders and blocks which everywhere lined the shore."

On the return to the coast, Lake Hikwa was visited. "We saw it from an altitude of about 8000 feet above the sea, its surface lying more than half that height beneath us, and the mountains rose in such perfect precipices all round, that it seemed as if we could throw a stone into it. One of its peculiarities is, that it has no visible outlet—a fact which admits of little doubt. From my own personal knowledge I can say that none exists either north, south or west, while Elton and Cotterill, in passing near its eastern side, found no stream flowing from that direction."

Of the one hundred and fifty men who started on this remarkable and most successful journey all but one reached the coast again, arriving in the best of health and condition after traversing no less than 2830 miles, of which 1300 were over entirely new ground.

AFRICAN EXPLORATION.—Dr. Emil Holub proposes to make a journey through Africa from the south to the north, starting from the borders of the British colonies and visiting first the Zambesi and the Marutse-Malunda country. Then crossing the watershed between the Zambesi and Congo he will explore the region around the sources of the latter river, after which he hopes to reach the utterly unexplored region north of the Congo and make his way through Darfur into Egypt. Dr. Holub anticipates ac-

complishing this extraordinary journey in the space of three years, at the cost of rather more than $25,000.——The French explorer, M. Savorgnan de Brazza, is again pursuing his explorations on the Ogowé, and at last accounts (July 14th) had started for the Congo after establishing a station at the junction of the Passa and Ogowé. His former companion, Dr. Ballay, is about to rejoin him, and the French section of the International Association sends out with him M. Mizon, who will establish a new station on the Ogowé. M. de Brazza had engaged 750 men for this latter expedition, who will ascend the Ogowé as far as the Alima, taking with them, in canoes, the sections of a steam launch.——Major von Mechow, who was sent out by the German Government eighteen months since to explore in Angola, left Malange on the 12th of June last, and arrived on the banks of Quango on the 19th of July, at a point below the great water falls, and considerably beyond the limits of Messrs. Ivens and Capello's explorations. Although the expedition was everywhere well received by the negroes, yet the hilly character, with its countless deeply-carved valleys, offered many obstacles to the transport of the goods and of the composite boat. For instance, the Cambo, a tributary of the Quango, which it joins between the two waterfalls, had to be crossed four times. The camp of the travelers, at the time of the despatch of the letter, was pitched below the falls, the more southern of which, called by the natives "Succambunda," now bears the name of the "Emperor William falls," while the northern one, called "Gombé," has been re-named the "Emperor Francis Joseph falls." The traveler intends to descend the Quango, which here is already very broad, in his boat as far as its junction with the Congo, and then to return. Everywhere the height above the sea-level was determined, and astronomical observations taken.——Two other Germans, Messrs. Pogge and Wissman, have also gone to Angola, in order to penetrate into the kingdom of the Muata Yanvo, whom Dr. Pogge visited in 1875.——Dr. Oscar Lenz, who was despatched by the same society in the latter part of 1879, has succeeded in reaching Timbuktu. He started from Tangier on December 22, 1879, in company of Hadj Ali, nephew of the celebrated Abd-el-Kader, and was disguised as a Turkish doctor of Constantinople. He met with a friendly reception at Timbuktu. He arrived at Medina, Senegal, on November 2, 1880. Of the three Europeans who have formerly visited Timbuktu, Major Lang (1826) was murdered; M. Réné Caillié two years later brought the first accounts of it to Europe, and Dr. Barth, in 1853–4, spent some months there.

MICROSCOPY.[1]

FERTILIZATION BY MEANS OF POLLEN-TUBES.—Mr. J. Kruttschnitt, of New Orleans, has been engaged for some years in the study of the pollen of flowers, the formation and history of the pollen-tube and its relation to the theory that each ovule is fertilized by a tube which descends from the stigma, reaches the ovule and enters its structure through the micropyle. His conclusion that this theory is radically erroneous, and that the functions of the pollen-tubes need re-examination, derives its force from the fact that, being an experienced, cautious and thoroughly capable observer, he has enjoyed exceptional opportunities for the study of the subject in plants most suitable for the purpose, and that the uniform result of his numerous experiments has been contradictory to the accepted theory. During the past few years he has examined thousands of cases, and has confirmed his observations in some 500 instances by mounted specimens, which show with great clearness the facts as they existed at the time of cutting the sections. Yet he has seen no pollen-tubes in contact with the ovules, nor anywhere near them, though examined during the times when fertilization must be taking place, if at all. On the contrary, the pollen-tube is always lost sight of near the stigma. The length of the style is such in many flowers that the pollen-tube would have a long way to travel to reach the ovule, and the arrangement of tissue is often such that nature would seem to have placed the greatest difficulties possible in the way of fertilization, instead of taking such a direct and certain way as would reasonably be expected. Mr. Kruttschnitt, therefore, concludes that it is next to impossible for fertilization to take place by the pollen-tube coming into actual contact with the ovules, and that, in fact, the whole ovary is impregnated with the substance of the pollen. He seems to suspect that wooden fibers or spiral ducts, leading in many cases directly toward the ovule, have been formerly mistaken for pollen-tubes. All these features are exquisitely shown in a special box of preparations just contributed to the Postal Club.

As to the general proof of the new theory, it must be admitted that the evidence is mostly negative, and that negative is at best a poor off-set for positive proof. That one man, however capable and thorough, has not seen a thing is overbalanced a thousand times by the fact that another capable and candid observer has seen it. The first may have taken the chances however small, which missed seeing that which did exist, the second could not really have seen that which did not exist. Still further observations, therefore, extending over a greater length of time, will be required to shake belief in a theory which has been so long regarded as a fact, and which rests upon the most positive and universally believed statements of fact. On the other hand it

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

must be admitted that so capable an observer, with unlimited opportunities for favorable observation, would be extremely likely to see the pollen-tubes at or near the ovules, if they really were accustomed to reach that locality; also, that there might be danger of mistaking other structures for pollen-tubes at a distance from the stigma, that the difficulties to be encountered by the pollen-tube in reaching the ovule would be very great in many cases, and that it would be almost a miracle if all the seeds of some plants having a vast number of ovules should be fructified individually by separate grains of pollen. It should also be remembered that the statement of early observers are often handed down as facts, without verification, by subsequent writers, and that proof of such a theory as that of the fructification of the ovule directly by the pollen may seem stronger than it is, a great number of statements to that effect resting (possible) on a much more limited number of really independent statements. The early observations, too, which established the accepted theory, must have been made with lenses of inferior defining power and without the advantages of staining, which would now render error much more improbable. Furthermore pollen-tubes may in some instances have really been seen in contact with the ovules, and a general theory have been drawn from the fact, when their presence there was exceptional and not normal, or at least not general. The proof of the old theory is therefore not so positive as it seems; and the theory must be to some extent an assumption founded upon facts whose significance is not beyond dispute.

Though analogy is often an unsafe argument, the doctrine of fertilization of the whole ovary by the pollen is well illustrated, to say the least, by the ferns and others among the lower plants which produce fertile spores indefinitely as the result of a single earlier fructification. On the whole, while far more proof will be required to convince the world of the correctness of the new theory, still the very interesting and able studies of Mr. Kruttschnitts seem sufficiently conclusive to call for a reconsideration of the old theory, or at least, for a revision of the proofs upon which it rests.

American Microscopical Society of the City of New York.—Owing to a misapprehension which appears to have been recently encouraged by interested parties, friends of the American Microscopical Society of the City of New York—the oldest incorporated Microscopical Society in the United States—are notified that the name of the Society *has not been changed, its meetings discontinued, or its large and valuable collection broken up and scattered.* At the recent annual election the following officers were elected for the year 1880: President, John B. Rich, M. D.; secretary, O. G. Mason, Bellevue Hospital.

SCIENTIFIC NEWS.

— The National Academy of Sciences held a meeting, November 16th–19th, for the reading of papers by its members at New York. From the annual report of the president, Prof. W. B. Rogers, we take the following statement, showing the practical nature of the work already performed by the members for the Government, and who are elected solely from the excellence of their original contributions to pure science.

The National Academy of Sciences was established by Act of Congress in March, 1863, with power to frame its own constitution, select its own members, and provide in other respects for its continuance and successful operation.

The object of the Academy is to advance science, pure and applied, by original researches; to invite the attention and aid of the Government to scientific inquiries of especial public importance, to be directed by the Academy; and especially to investigate, examine, experiment, and report on any subject of science or art whenever called upon by any department of the Government.

The Academy contains at present about one hundred members, representing within their ranks nearly every department of knowledge, whose services, in accordance with the charter of the Academy, are always at the disposal of the Government.

The Academy by its charter is made in a sense the scientific adviser of the National Government, and has, therefore, been frequently called upon by the departments for suggestions or researches on scientific questions bearing upon the public interest.

The Report gives a summary of what the Academy has done since its foundation in aiding the Government by its scientific advice and coöperation. The special investigations thus undertaken amount in number to thirty-one, on such subjects as the magnetic deviations in iron ships, the national currency, the expansion of steam, the prevention of counterfeiting, the improvement of Greytown harbor, Nicaragua, the distinguishing of calf's hair goods from woolen goods, silk culture in the United States, the measurement of the velocity of light, the preparation of a magnetic chart of the United States, and similar subjects, together with reports on weights, measures and coinage.

As the Report states: "A consideration of the value of these labors, and of the prompt zeal with which the Academy has always responded to the calls of the Government, should incline the National Legislature to continue the wise policy of making ample provision for the scientific work undertaken by the Academy at the request or with the sanction of the Government. Researches of the nature of some of those here enumerated, require

costly instruments and the coöperation of many persons, it may be for a prolonged period, and, of course, cannot be brought to the most satisfactory results without an expenditure of money corresponding to the nature and duration of the work.

"It is much to be regretted that the Academy is not provided with the means of publishing its scientific and other productions. Since its establishment, upward of five hundred papers, many of them possessing great scientific value, have been contributed by its members and by others who have been invited to take part in its sessions. Some of these, it is true, have reached the circle of scientific readers through other channels of publication, but it cannot be doubted that the interests of science, as well as the dignity of the Academy, would be promoted by the annual publication of a volume of its scientific memoirs and other proceedings under its own direction and authority.

"As a recognized counselor of the Government, frequently called upon for important scientific service, it is thought that the Academy may reasonably hope that provision will be made by the Government for such publication."

— As a result of the explorations of the United States Fish Commission within the past ten years, 1000 additions to the Maine invertebrate fauna of New England have been made; many of them, however, have been independently discovered by Prof. Verrill, who also has had charge of these explorations undertaken by the Commission. Moreover, the Commission has discovered one hundred species of fish near to the eastern Atlantic coast, of which about fifty are new to science. One of the more important features of the work is the preparation of life-histories of the useful marine animals of the country. More or less complete biographical monographs have been printed on the blue-fish, scup, menhaden, salmon, and the white fish, and others are nearly ready. The embryological history of the cod, shad, alewife, salmon, smelt, Spanish mackerel, striped bass, white perch, and the oyster have been studied, under the auspices of the Commission, by Messrs. Brooks, Ryder, Schaeffer, Rice and others. A pleasant tribute to the success of the Commission in its general work and its exhibit at the Berlin International Exhibition was the award of the first honorary prize by the Emperor of Germany to Prof. Baird, who is regarded in Europe, in the words of the president of the German Fischerei Verein, as the first fish culturist in the world.

— The steamer *Blake*, Commander J. R. Bartlett, U. S. N., Assistant Coast and Geodetic Survey, under instructions from C. P. Patterson, superintendent of that survey, lately read a paper on a dredging trip of three or four weeks off the coast between George's bank and the latitude of Savannah. The lines dredged over, approved by the superintendent, were those selected by

Prof. A. Agassiz, who accompanied the *Blake*, having special charge of the results of the dredgings, all of which proved to be eminently satisfactory to him, many new forms and facts being obtained. In effecting the dredgings, over a line off Charleston, S. C., nearly normal to the coast, across the Gulf stream, Commander Bartlett found the depths much less than expected. This induced him, although the trip was one primarily for dredging, to extend the work of sounding, and he accordingly ran a line of soundings nearly along the warmest band of the Gulf stream, commonly called the axis of the stream, for a distance of 150 miles, from lat. 32m. to lat. 33m. 30s. north, on which he obtained depths varying from 233 to 450 fathoms, where it was supposed that the depths would range from 600 to 1000 fathoms. At the north-east end of this line, in about lat. 33° 30′ north, the depth suddenly increased, in a distance of 15 miles, from 457 to 1386 fathoms. These depths obtained by Commander Bartlett, appeared to indicate that a submarine table land may extend from the coasts of North and South Carolina across to the Northern Bahamas.

— Lieutenant-Commander Sigsbee's gravitating trap for collecting organisms at different depths, was described by Prof. Agassiz, at the last meeting of the National Academy of Sciences, who also reviewed the more important results determined by its use. It was found that to the depth of 50 fathoms the same organisms were taken as at the surface. The next 50 fathoms contained the same types, but the genera was less numerous. They counted 17 genera of pelagic organisms upon the immediate surface in one of these investigations, but only 5 of them were brought up when the trap was let down to a depth of 100 fathoms. Prof. Agassiz concluded with a high compliment to the ingenuity of Commander Sigsbee, whose invention had surmounted so many of the difficulties connected with the study of submarine biology.

He believed that the bodies of pelagic organisms brought up from great depths were the carcasses of animals that had perished of age or accident upon the surface, and had slowly settled to the bottom to furnish food for its living hosts. It required from three to four days for a dead tunicate to sink to the depth of 1000 fathoms.

— Many sheep and lambs have recently been worried on sheep farms in the neighborhood of Dundee, Scotland. An unusual method of sheep worrying was recently perpetrated on the farm of Pickstone, tenanted by Mr. Campbell. One morning a lamb was heard bleating in one of the fields on the farm, and, as no lamb could be seen on a casual inspection, a more careful search was made, when it was found that the bleating proceeded from a lamb that was buried in the land, the only part left exposed being the head. It was at once evident that this had been the

work of a dog. The lamb was taken out, and was, strange to say, little the worse of its burial. A diligent watch was instituted, with the result that the depredator—a collie dog—was captured in the act of burying another lamb, which was also alive.

— The new building at South Kensington for the British Museum was finished last June, and the geological, botanical and mineralogical specimens have been removed from the old building. The zoölogical collections, which are equal in bulk to the other three collectively, have yet to be removed, as the necessary funds for this purpose have not yet been appropriated. Professor Owen, the veteran Superintendent of the Natural History Collection, still actively directs the labors of his assistants. A biographical notice of Professor Owen and an excellent portrait by Jeens appeared in *Nature*. He has lately designed an index museum in the new building, intended "to show the type characters of the principal groups of organized beings," thus epitomizing nearly the entire museum.

— The members of the expedition which, under the auspices of the Archæological Institute of America, is to investigate the ruins of the city of Assos, in Asia Minor, will sail this week in the steamship *Germanic*, of the White Star Line. The party comprises Joseph Thatcher Clarke, of Boston, who will act as the leader; Francis Henry Bacon, of this city; Maxwell Wrigley, of Brooklyn, and two or three other gentlemen who are interested in archæological research. Through the Department of State, the Turkish Government has offered the members of the expedition every assistance in its power. Assos is on the southern coast of Mysia, opposite the island of Lesbos, and contains among other things the ruins of a Doric temple, a theatre, and massive fortification walls.

— The following calculation as to the total number of existing botanical species, has been recently made by Dr. Müller, of Geneva. We have at present in our books about 130,000 species, and if we suppose that 30,000 (in round numbers), belong to countries like Europe and North America, where there are hardly any species, but some cryptogams to be discovered, the remainder, or 100,000, representing exotic plants, more or less tropical and southern, we may double the latter for new species, giving 200,000 for these less known regions, and altogether 230,000 for the whole globe, with the exception of countries still quite unknown botanically. Adding only 20,000 species for the latter, we reach a minimum sum of 250,000 species of plants.

— Dr. B. W. Richardson, in a paper read before the Sanitary Institute (Exeter, September 20, 1880), seems to approach the position of Professor Jäger. He writes: "Go into the wards of a

lunatic asylum, and notice among the most troubled there the odor of the gases and the vapors they emit by the skin and the breath. That odor is from their internal atmosphere, their nervous ethereal emanation. They are mad up to suicide or murder, or any criminal folly. Can it be otherwise? They have secreted the madness; they are filled with it; it exhales from them. Catch it, condense it, imbibe it, and in like manner it would madden any one." Is not this the teaching of Jäger and Dunstmaier, spiced to suit the audience and the occasion? — *Journal of Science.*

— M. E. Yung (*Comptes Rendus*, August 30, 1880) has studied the development of the eggs of *Loligo vulgaris* and *Sepia officinalis* exposed to light of different colors. The development is hastened by violet and blue light; retarded by green and red. Yellow light behaves like white light. Larvæ of *Ciona intestinalis* also grew most rapidly in the violet light. Development under the red and green lights, though retarded, was effected in perfection.

— Besides issuing the beginning of what will be a most valuable series of monographs on the Mediterranean fauna studied at Dr. Dohrn's Zoölogical Station, a provisional priced catalogue of the microscopical preparations issued by the Station at Naples, has been published. It includes four different preparations of Protozoa, 33 of Cœlenterata, 49 of Echinodermata, 33 of Vermes, 57 of Arthropoda, 54 of Mollusca, and 193 of Vertebrata. These will be as valuable as any ever sold. The price is from one to ten francs.

— As the result of Dr. O. Finsch's voyage of ten months in the Pacific Ocean he has sent to Europe about thirty boxes of collections, the materials embracing 70 mammals, 180 birds, 800 reptiles, 1200 fishes, 15,000 mollusks, 800 crustacea, 400 spiders, 1400 insects, together with 50 skulls and 55 casts of faces, representing the people of twenty different islands, besides 1500 ethnographical objects.

— A Young Men's Society for Home Study has been formed in Boston for the encouragement of systematic study and reading at home. The course in Natural Science, of which department Mr. S. H. Scudder is the head, embraces Botany, three courses in Zoölogy and two courses in Geology. The reading is designed to be accompanied by the study of specimens.

— We learn that the Rev. W. H. Dallinger, of Liverpool, the distinguished microscopist, has accepted the appointment of Governor and Professor of Biology at Wesley College, Sheffield. This institution may be congratulated on the acquisition it has made.

— The death of Mr. Frank Buckland, is announced in the papers of Dec. 18th. Mr. Buckland was the son of Dean Buckland, the distinguished geologist. He was well known as a pleasing writer on popular natural history, and as a fish culturist.

— A large and valuable collection of Rhode Island plants has been presented by Mr. James L. Bennett, of Providence, to the already increasing Herbarium of Brown University, of which Mr. W. W. Bailey has recently been appointed the curator.

— Prof. Thomas Rymer Jones, F.R.S., died in December; he was born in 1810; held the chair of comparative anatomy in King's College, London, and was the author of "The General Outline of the Animal Kingdom."

— Dr. E. Sequin, well-known as a leading American physician, philanthropist and physiologist, died in New York in October. He was born in France in 1812, and showed brilliant talents while a student in Paris.

— It is stated in the daily papers that the late Prof. Watson, of the University of Michigan left the sum of $50,000 to the National Academy of Sciences for the promotion of original research in astronomy.

— It is reported in the daily papers that a manuscript journal of Gilbert White, of Selborne, has been discovered. It is said to be of considerable length.

— Dr. Lauder Lindsay, who wrote on the subject of intelligence in the lower animals, and who was an authority on British lichens, died in December last.

— Prof. Ernst Hampe, a distinguished German bryologist, died recently at Helmatedt, aged 85 years.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

New York Academy of Sciences, Dec. 20.—Professor C. H. Hitchcock read a paper on the ancient volcanoes of New England, and Dr. R. P. Stevens exhibited some rare silver ores and carboniferous fossils from Arizona.

Boston Society of Natural History, Dec. 15.—Notes on the geology of Mt. Desert were read by Mr. Wm. M. Davis, and that of the adjoining Frenchmen's Bay was discussed by Mr. W. O. Crosby. Mr. J. S. Kingsley spoke of some points in the anatomy of Holothurians. Dr. Edward Palmer showed some objects of ethnological interest from caves in Mexico.

APPALACHIAN MOUNTAIN CLUB, Dec. 10.—Mr. H. Murdock read a paper on Mt. Cardigan, including accounts of several ascents.

AMERICAN GEOGRAPHICAL SOCIETY, Dec. 23.—Mr. Thomas Davidson read a paper on the recent excavations and discoveries at Athens and Olympia.

MIDDLESEX INSTITUTE.—At an adjourned meeting of the *Middlesex Scientific Field Club*, held on the 8th of December, 1880, the name of the club was changed to that of *Middlesex Institute*, by which name it will hereafter be known.

BOSTON SOCIETY OF NATURAL HISTORY, Jan. 5, 1881.—Dr. M. E. Wadsworth discussed the appropriation of the name "Laurentian" by the Canadian Geological Survey. The President gave further details of the structure of the carboniferous millipedes, to show that they should be classed as a distinct suborder of Myriapods. Mr. F. W. Putnam exhibited some supposed Palaeolithic implements from Massachusetts, and spoke of their discovery and character. Mr. J. S. Kingsley presented a collection of Crustacea and remarked on some of its rare or curious species.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

GEOLOGICAL MAGAZINE.—December. Notes on the occurrence of Stone Implements in the coast latitude south of Madras, by R. B. Foote. Analysis of Moa egg-shell, by A. Liversidge. Classification of the Pliocene and Pleistocene beds, by C. Reid. The Mammoth in Siberia, by H. H. Howorth. (The writer maintains that in former times when the mammoth abounded in Northern Siberia, the climate of this region, extending from the Ural mountains to Behring straits, Siberia, was much milder and like that of Lithuania at present "where the bison still survives, and where so many of the other contemporaries of the mammoth still live.")

ANNALS AND MAGAZINE OF NATURAL HISTORY, November.—On the minute structure of the recent *Heteropora neozelanica*, and on the relations of the genus Heteropora to Monticulipora, by H. A. Nicholson. On *Stromatopora dartingtoniensis*, n. sp., with tabulation in the larger branches of the Astrorhiza, by H. J. Carter.

AMERICAN JOURNAL OF SCIENCE, January, 1881.—The Albany Granite, New Hampshire, and its contact phenomena, by G. W. Hawes.